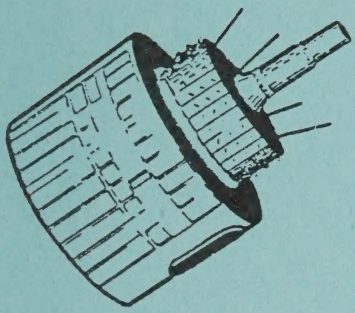
NEWSLETTER No. 18



REMOTE IMAGING GROUP

SEPTEMBER 1989

REMOTE IMAGING GROUP (R. I. G.)
NEWSLETTER No. 18 SEPT 1989

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EDITORIAL & SECRETARIES PAGE

First of all a late newsletter again. I will not quote the diatribe of problems except to say the need to earn a living and a recent exhibition at Alexandra Palace got in the way.

I hope something you will all notice is the typeface/fonts used in this latest edition. Our previous efforts have been printed in Courier. Now we are trying out Helvetica which offers variable spaced fonts, which is now possible through our recently acquired HP Laserjet II printer. This is only the first step in the long road (the learning of..) towards Desk top Publishing on which we are travelling. The biggest tip I have learnt is not to use hard spaces in your text, use TAB settings always. The basic newsletter skeleton has had to be completely revised in that manner, no mean task.
Any suggestions re layout/fonts used/other 'bright ideas' are invited.

Anyway on to this edition.

Many members who read this newsletter end to end will realise the different directions we seem to be heading on. In our members letters section we have requests for beginners articles, complete with detailed inventory of requirements (many thanks Sam); yet our main lead article is on Hi-res images from American satellites!

In the same manner as other newsletter 'editors', for the most part I print what I receive and I am most grateful for any contributions and especially the one from John Dubois who has now 'mastered' VAS reception and is proceding with NOAA HRPT using a PC. The aim as I understand it is to bring such reception techniques into the amateur arena. Such systems can be purchased today if your pocket is deep enough, eg £25,000 - £150,000 and beyond. Anyway watch this space.

But back to the beginners articles, I do make a further request to all those members who have just got going to write in and tell of their experiences for the benefit of others.

The specialist parts needed to make the preamp described in the last issue are to be made available from RIG at a very sensible price. Hopfully this news is printed elsewhere in this issue.

Members should be reminded that all VHF Receivers and Down-converters are on 28 days delivery so please be patient, I've had several calls at the 14 -21 day mark asking where is it? Also Dishes, after a long drought the supply of dishes and horn feeds has finally reached our Distribuion point in Manchester, Mike Horrocks, so those waiting should contact him asap. Thanks to Peter Brazier for arranging the transport.

Anyway I close with the best intention of getting the December newsletter out befor Christmas and the hope that the membership will sent in something to print!!

Best Wishes
Phil

CHAIRMAN'S WAFFLE

Henry had a problem. Henry's soldering iron stopped working. It was a Weller TCP1. The replaceable tip was somewhat smaller than it should have been. So what, replace it! Easier said than done. It was rather corroded at the end. Tough, get some large pliers and loosen it up. OK, but the heater came out. By the way it is bifiliar wound, just in case you didn't know. A somewhat difficult problem, get a new one, but I need it now! Well as some of you might know Henry throws very little away (correction my wife says I never throw anything away). In days gone by I had a similar problem, but not quiet so drastic. That time the thermostat had stuck on and I had a rather hot soldering iron. Over the course of time I had gathered a spare soldering pencil, well the 24v part, so I simply replaced the faulty one with the good one. Several years later, now, it goes wrong again. I had a kit of parts on my hands and needed spares. yes you've guessed it I still had the original faulty pencil! It only took a few seconds to find (as long as my son hadn't sorted things out) and between the two pencils I had a good thermostat, a good heater, a good sleeve to hold the tip in and a bakealite handle which didn't have threadless screw holes. OK, so I assembled it all, until I came to the 24v plug. It was soldered on and it needed to be changed. Use another soldering iron, but I haven't got another soldering iron! When you live in the outback like Sutton St. James you have to use a bit of intuition now and again. I held the good soldering pencil's wires on the socket's 24v until it heated up and then I could desolder the scrag ends of wire from the plug, and tag the new ones on. I then plugged it in to finish the job properly. You

have probably guessed the next bit that as there wasn't any good parts left in the remains they got thrown away, which proves that I do throw things away, but only when they are completely duff!

Henry had a second major problem. After saying that framestores don't go wrong, they just keep on going and going was obviously asking for trouble and I got it. Not just simple faults, but moderately complicated ones. A few weeks ago I noticed a temporary effect on the framestore where the stored picture is good but then no more lines are written into memory and the stored picture disappears out the bottom of the screen at 5 - 10 times the normal speed. This had me scratching my head for several days because when I settled down to repair it, the fault would disappear and the framestore would behave itself. Fortunately this fault became more frequent and eventually was there all the time. This fault was not a difficult one to find. It was caused by yours truly himself. In the interests of stability I had used Silver Mica capacitors in the phase lock loop timing circuit. These are somewhat larger than the original component and had to be soldered onto the underside of the board.

They had been lying on the large wooden chassis that also serves as a bench and the legs had obviously had some strain on them and eventually caused a small intermitency, and then an open circuit leaving the phase lock loop to run up to it's maximum frequency. This was soon corrected and didn't cause any more trouble, but I shall have to replace those 6 inch nails I used for PCB pins! My troubles weren't over with just a small fault like that. A few days later whilst I was standing very close to the framestore, a CMOS integrated circuit decided that it wanted a bit of fresh air. My hand was only about 6 inches away from it at the time. The effect is best described as being very similar to a tantalum capacitor destructing itself when reverse volts are applied. Perhaps there are some good points in having your framestores inside a box! The I.C. removed a conical shaped piece of its packaging, about 6mm diameter at the surface. I looked most carefully at it and thought that I would have to be very dexterous if I was going to super glue the black plastic bit back in!! Reverse volts cannot be applied because there is a diode in series with the supply onboard, so it wasn't that. What caused this all to happen is still beyond me but the things that I had to replace were reasonably straight forward. I.C. 122 on board 001 was having trouble with it's central heating thermostat and wasn't giving out much 1MHz. This was changed and gave me more 1MHz output. I.C.210 on board 002 had blown its lid off so this was also changed. The only chip between this later

device and the first chip is I.C.207 so it was also changed. All of this work had to be done very carefully because the only sockets that I had installed when I had built it, were used for the memory chips. This was an occasion not to be missed and sockets were installed for these chips. Then comes the big switch on. Does it work? Nothing! Not even syncs to lock the monitor! Another Henry Catastrophe? Something rather Fishy M. here (or was it Bacon J.?).

My son had been using the same monitor for watching satellite TV and had not reconnected the video lead. A quite word was had with him after my nerves and temper had subsided. After I had corrected this minor deficiency it all worked as if nothing had gone wrong in the first place. Later, when this was all completed I was rather pleased with myself because I had repaired it myself and hadn't had to have a word with Les. I might now be able to help a local RIG member, because his framestore is only giving 16 levels out and is definitely not up to par. It also helps to have a working framestore to compare a faulty one with.

We all waited for the arrival of the first signals from MOP 1, now called MET4. Yes they were 3db down on the last satellite and those few db's are sorely missed. I could still get nearly noise free signals with the LNA described in the last Newsletter but, you've guessed it, the GASFETs had a short life and joined the ever increasing number of deceased carcasses that litter Henry's shack. What did I do this time? Well they worked very well for several days, until Henry decided to tidy the unit up. That's fatal around here. The first thing wrong was that the input UT141 (semi-rigid coax) was 12 inches long whilst the article gave a 1.5 inches maximum figure. So I shortened it. I turned the supply off, chopped off the surplus and prepared the end to take a brand new plug. You need a lot of heat to solder the plug on more than Henry anticipated. When I switched on.....nothing..... Henry had done it again. It must have been cumulative soldering time. Somewhere I have a small pair of heat sink clips that we were told to use on the leads of the very early germanium transistors. I must find them for future use. I blew both of the devices and am awaiting the arrival of the next pair. The LNA worked extremely well until those fatal moments. Yet again has my pocket been hurt when I haven't kept my fingers out of working equipment!

The pictures in the last newsletter were from yet another source, and reports from most people express a further improvement. I feel that we cannot achieve any further improvement without expending

unrealistic sums. I now hope that the pictures can be left to the experts and that we can concentrate on the contents of the pictures used. There is a possibility that old LANDSAT frames might be used to give you some idea of the quality of the very high definition systems in use today. The test card from James Brown was perhaps a bit hard on the printers but it does show what can be obtained using a **Quad Loop Yagi**. All those unbelievers out there that say they are useless except for sparrow perches should get their LNA's examined. They do work! I really shall have to start producing them. I could probably make more profit manufacturing them than I do on the farm. Mind you I was having labour problems there. It's the usual saying, if you want anything doing, do it yourself. This seasons harvest has gone very well so far. We had completed 88% when it rained, just another day and I would have been finished. My ole combine's been going well this year. She's not seen the other tyre to match the one she had trouble passing last year. Nor has the owner been to collect it. The combine is a "C" reg, suffix not prefix. She's 34 years old, I've had her for 29 years, but shes got to last several more years yet. I think it's a race to see who gets the pension first! By the time you read this I should be well on the way to getting next years crop sown and the main harvest panic should be over.

Someone was asking me if I had ever seen those concentric circles or symmetrical marks in my fields of corn and if it really was the Young Farmers Clubs? My mind boggled at all the answers I could have given to that lot! Around here the YFC's have very few genuine young farmer members in them. They seem to be only remotely connected with farming nowadays.

They band together under the title of YFC but probably less than 20% are the real thing, more the yuppy and green welly brigade, and as far as farming is concerned it's more a case of what colour was his new SRI before he took it for a swim in the local drain or how comfortable is the back seat? Back to the original question, I haven't seen anything similar to that described on TV but I have seen small areas about 4 metres across that have been grazed very short, probably by Hares. Perhaps it was one of their regular meeting places for their WI or MU. There was a good lot of residue left behind! Obviously things are very similar in the animal kingdom. The thoughts of green wellies reminds me of the Organic lobby which may be a good thing for some, but going by Henry's nearly non existent Kitchen garden (Farmers never like doing anything in the garden unless they can do it on a tractor) and the few things

that it does provide which survive with hardly any care and attention. You might grow a good cabbages, you can weed them, you can look after them, but when it comes to eating them, they may contain a lot of undesirable organic materials such as caterpillars, black fly and a host of other juicy additives. I prefer my trace elements to be in the recognizably form of vitamins and minerals! Sprays nowadays are very much more tested for safety than they used to be and the dilution rates are becoming even higher (weaker). Used correctly (I use about £5000 worth per year) modern chemicals have become an essential part of modern day Agriculture. For those of you who are Organicists, keep up the good work, but we all know where it (manure) comes from in the first place!

At times I find it difficult to know what to include in my chairman's waffles. "Difficult to imagine?" I can hear some of you saying, but it does happen. Sometimes I just need trigger words or ideas and then I'm off again. Some restricted circulation review/monthlies do have up-to-date development products and ideas in them. I was given one called "New Electronics" just recently and it proved to be a mine of information and I would certainly like to receive it regularly. To qualify for a free copy you have to be in manufacturing or something similar or pay something like £3 per copy. Our old faithfuls like Electronics and Wireless World are expensive enough without having to pay double. I wonder how many of the free gratis copies are filed in the usual place without even being opened? My wife says "what do want any more for, you haven't read that 12 inch deep heap in the corner yet?!" I must confess that she is correct but that I have already scanned through them and just haven't had time to go through them slowly. If there had been any juicy bits in them I would have detected them the first time through. I suppose it's a case of everybody being right in their own way and I've just got to streamline the system or else they will be out for the dust -cart. May I also thank those of you who told me how much you enjoy reading Henry's Waffle.

It seems that I haven't wasted my time composing these literary works of art! Mind you flattery might get you a free years subscription but I don't think the committee would approve of that. I did have one complaint, that I jump about from one subject to another, to which I plead guilty. It takes about 10 sessions to create a Chairman's Waffle and my line of thought is not always as straight and continuous as I would like it to be, I get sidetracked very easily!

I've also been told that Ron Broadbent and I are very similar. Look I know that I'm a mean old ****** but don't be offensive to Ron. I'm just very careful and miserable with it! Ron is the opposite. Is that right Ron?

I must apologise to any of you who came early to the RIG stand at the Elvaston Castle Rally. Things just didn't work to start with, and it was most important to have something working. Troubleshooting was my first priority and when it was all working I could settle down to a normal rally. We had several leads missing and some faults as well. A jack socket which was shorting out didn't help matters, but it was all dealt with eventually. Again my apologies if I wasn't as courteous as I should have been. Did I say our panics would be better organised now we have a rally organiser? There must be a moral in there somewhere! Whilst looking round at Elvaston one thing which did catch my eye was the stand in the middle demonstrating those devices for drawing parallel lines etc. Buy them there and you could get the large one and a smaller one for much less than the price of the larger one. Henry liked the idea and had nearly extracted the money from his pocket when I changed my mind and saved the money that I hadn't spent. Five days later I had a lot of drawing to do and one of those devices would have saved me an awful lot of time. There must be another moral there somewhere.

Whilst on the subject of rallies, I like to get a quick look round before the public are let in if possible. It's not very often possible, but it is so much easier to see what there is, when I can. All the stands with brand new and expensive boxes on them, I walk straight by, I cannot afford them so why look? All the regular stands are very much the same from one rally to another, just minor changes. It's those stands that you only see possibly once that interest me, they have the special bits and pieces that don't appear on the others. It's the same with car boot men, they are well worth a quick eyeball, just in case. Just a little bit of politics here to say that a few years ago at a exhibition which was very expensive to get in, and if I hadn't travelled so far probably I would have refused to enter and returned home. Remember that the traders want to sell you their products. They want your hard earned cash. You shouldn't have to pay for the privilege of spending your cash. A nominal entrance fee perhaps but not several pounds! We all want a good selection to choose from but you and they must remember that the customer is always right, even if they are wrong.

What is going on in the Derby, Longeaton, Ilkestone and Notting-

ham area? I hear things are going on there surreptitiously. Well you think we don't know, but we have heard about some of them. So own up, put pen to paper and tell us what you have been up to, and then we might let you off! If you don't keep an eye on them they will be forming a breakaway group! So to make certain you don't get ostracised get those confessions into Phil without delay.

Those of you with AMIGA 1000 and the ICS package, is your crystal 28.6363 Mhz? If it is then it is the wrong one, get it changed and everything will then work OK. Further details can be had from James Brown.

During the last few weeks I have borrowed the groups equipment to give a demonstration at a local school. That in itself went well but didn't result in any extra members.
It was more of a public relations exercise. Whilst the equipment was in my custody I took the opportunity to loan it to a friend who was possibly interested. The bug didn't take long to infiltrate into his system. He soon ordered a Dartcom receiver via RIG, and it was in a box nearly before you could get the polystyrene packing beads into the rubbish bin, and he made a good job of it. He had borrowed the framestore as well and quickly saw how simple it is to operate. He is now waiting for his own framestore boards. Also whilst the equipment was here the **Quad Loop Yagi** and the Dartcom Downconvertor were loaned to another friend who already has a 137MHz system working. He is now busy constructing a **Quad Loop Yagi**. I do have a piece of equipment that might suit someone. It is a Siemens "Hell Fax" machine. It is very well engineered and would probably suit someone who is embarking on the construction of a photographic copy unit. It is larger than the Telecopier 400 but it appears to be very well made and should be capable of modification. I do not know if it works as it is but it's exterior condition would indicate that it has been well used and semi well looked after. I rescued it from the local emporium at a moderate cost, to save it from the big hammer, and would welcome offers for it. I had originally meant to take it to Woburn but forgot it at the last moment in the rush.

If any of have access to CQ-TV 147, there is a good article in it by Leslie Kaye. It's a beginners guide mk.2 with a plug for software tagged on. Interesting reading but the reciprocal comment had me wondering. I bet if other signals appeared on the usual channels there would be a lot said by everybody. Look what happened when the paging systems first appeared, and they were legitimate. It's

nice to have something that quiet for a change.

It need not be in anything like mint condition, as long as it works and will connect straight into the IBM port. I find that the word processor is essential now, but often when a file has been printed for me on someone else's system there are a few annoying mistakes which need correcting. If I could get draft copy myself, I could then make certain it was correct before getting it printed on a Letter Quality printer. So any ideas or offers please? Contact me via the address or phone number given on the inside front cover.

Best wishes until the Christmas/1990 Newsletter arrives.

Henry

(Presented at the Third International Satellite Direct Broadcast Users Conference – Baltimore International Airport Hotel, June 20-24, 1988)

(Updated 18 August 1989 to include recent advances in LNA design)

Techniques for Very Low Cost Reception of GOES Mode AAA VAS

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INTRODUCTION

Digital image data broadcast by the GOES satellites presents an exciting opportunity for the advanced amateur, engineering student or school to directly obtain high quality multispectral images of the earth. When the GOES system was designed in the early 1970's the technology necessary for direct reception of the GOES VISSR digital image broadcasts was very expensive. The necessary RF hardware (neglecting for the

moment any data handling or display) to receive these broadcasts would have cost at that time at least two orders of magnitude more than a typical amateur radio station. Then, at least that amount again would have been necessary to assemble a basic digital processing and display facility. A second obstacle to amateur or educational construction of such reception hardware was the technology itself. Binary phase shift modulation of an RF carrier at 1.6 GHZ by a 1.7 MBPS data stream, while not on the leading edge of digital communication technology, was sufficiently intimidating to amateurs or students to inhibit experimentation. These two factors, cost and complexity, served to restrict direct GOES VISSR reception to government and commercial users for almost two decades.

Three fortunate, largely unrelated, technological developments have since converged to significantly change this situation, one evolutionary and two sudden and innovative. The evolutionary trend is a steady advance of electronic device technology and a corresponding decrease in component cost as large areas of this technology are drawn into the worldwide consumer products market. The component of greatest significance to low cost direct GOES digital broadcast reception is the GASFET transistor. The material gallium arsenide began to appear in practical RF semiconductor devices in the 1970's with the result of dramatically lowering the unwanted noise added to received signals. While quite expensive at first, their desirability in television, radar, microwave radio and satellite communication systems caused a steady improvement in quality and decrease in manufacturing cost. Low cost direct digital GOES reception would not be possible today without the GASFET transistor.

The first of the sudden, fortuitous, technological developments which to which we are indebted is the appearance of the personal computer. A digital computer was a necessary and integral part of the GOES ground system as designed in the early 1970's. The required computer, although not of large mainframe capability, was costly and unheard of as an amateur or dedicated school accessory. Early in the decade this began to change. Built around specialised large scale integrated circuits, microprocessors, surprisingly capable desk top "micro" computers became available at prices well within the reach of individuals and small institutions. It is beyond the scope of this paper to trace the development of microcomputers but the outcome is vital to direct low cost digital GOES reception. Today it is straightforward to

obtain a complete microcomputer with 1 megabyte of memory, 80 megabytes or more of fast access fixed disk storage, operating at a clock rate of at least 10 MHZ for less than three thousand dollars. This capability is actually well beyond that necessary for digital GOES image handling. Adequate specifications for use in a basic digital GOES system can be found in an "XT" class microcomputer costing about one thousand dollars.

The second convergent technological development was surprising and colourful when compared to semiconductor and microcomputer evolution. In the mid 1970's a few television networks and broadcasters began relaying entertainment and news programs, point to point, over then new commercial "SATCOM" geostationary satellites. As the convenience and cost advantages of this technique became clear, more and more program material was routed over these satellite channels in the range between 3.7 GHZ and 4.2 GHZ. Reception by individuals was probably never envisioned by the original system operators -- the equipment was very expensive and the antennas very large. Nevertheless, a few pioneering experimenters assembled surplus microwave and homebuilt equipment and began receiving these fascinating "private" television channels. This development has particular relevance to the subject of direct digital GOES reception. The original designers of commercial television SATCOM systems were very conservative. Using time-tested microwave design conventions, substantial reserve performance margin was built into the systems. In particular this resulted in the specification of large, typically 24 foot diameter, receiving antennas which at that time cost tens of thousands of dollars. The individual amateurs receiving these signals, however, were typically using cast-off microwave telephone system antennas 12 to 16 feet in diameter. They were receiving signals very close to the bare minimum of system signal to noise ratio -- a region of operation considered unusable by the system designers -- but obtaining quite satisfactory results _for their purpose_. The entertainment attraction of these television broadcasts, even though they were not intended for such use, quickly spawned an industry manufacturing and selling such systems to the general public. As with personal computers, the history of this industry is beyond the scope of the present paper but fortunately it produced an invaluable by-product, antennas, to the benefit of direct digital GOES VAS reception. Commercial mass produced TVRO systems require low cost parabolic "dish" antennas in the range from 8 to 16 feet in diameter. The upper

end of this range is suitable for GOES VAS reception and all that need be changed is the feed system. These antennas are widely available, sufficiently rugged for most climates, and far less costly that their professional counterparts.

In designing a low cost GOES VAS system we will take precisely the approach of early TVRO experimenters: by ignoring conventional system design performance margins it is possible to assemble a perfectly usable direct reception system at a fraction of the cost and complexity of a "professional" system. In return for this approach we give up the guarantee of images under virtually all conditions. The system will be more vulnerable to aiming errors, snow or ice accumulation on the antenna, mistuning and so forth. If one is willing to accept this trade off, the very substantial reduction in cost puts a VISSR system within reach of a modest budget.

GOES SYSTEM OVERVIEW

For those unfamiliar with the GOES imaging system, a good description can be found in the "GOES D, E, F Data Book" published by NOAA. GOES carries a wide variety of remote sensing and communications equipment. In addition to visible and multispectral infrared imaging, it monitors the earths' magnetic field, high energy particle flux in the vicinity of the satellite, and x-ray emissions from the sun. In addition a transponder system collects data from remote instrument platforms on the earth and retransmits it to central processing points. Also on board is WEFAX, a facsimile picture distribution system. In addition there are several radio channels dedicated to housekeeping and navigation.

The GOES multispectral imaging instrument is called "VAS" standing for Visible and infrared spin scan radiometer Atmospheric Sounder. It was called VISSR (Visible and Infrared Spin Scan Radiometer) on the earlier GOES 1,2 and 3 satellites and did not have the extended multispectral capabilities of the current generation. The high resolution images are created, visible and infrared simultaneously, by light from the earth falling on a vertical scanning mirror. It passes through a mirror system and filters which focus it on visible and infrared sensors. This is

a point focus on small sensors representing an individual picture element. Scanning comes, in the horizontal direction, from the spin of the spacecraft and, in the vertical direction, from stepping of a vertical scan mirror. The spin is 100 revolutions per minute or 600 milliseconds per horizontal scan. After each revolution the vertical mirror is stepped to bring the next "strip" of earth into view of the sensors. There are 1820 steps of this mirror so the whole image takes 18.2 minutes. There are multiple sensors at the focal point of the optical system so that at each sampling instant of the horizontal scan, two infrared and eight visible samples are taken. For infrared, resolution is such that these two samples represent about the same region on the earth at different wavelengths. For the visible, however, the optics are arranged so that eight simultaneous samples show a vertical strip of image and eight lines of the visible image are formed for each rotation

A digital multiplexer takes the eight visible samples, two infrared samples and various other samples of telemetry data and formats them into a digital data stream at 28 megabits per second. The data is four-phase modulated (QPSK) on a carrier at 1681.6 megahertz and transmitted to earth through a parabolic antenna. This antenna is "despun" or fixed in attitude while the rest of the satellite spins under it so that it can be precisely pointed at the earth. This transmission of 28mbps QPSK data at 1681 mhz is quite difficult to receive. So difficult in fact, that it was never planned in the overall GOES mission for direct distribution users to receive it. Instead, a more "user-friendly" signal called SVISSR (Stretched VISSR) was designed into the system. It is almost the same data sent at a lower data rate (2.11 mbps) which greatly eases the burden on direct users. Stretched VISSR, or more correctly now, stretched VAS, is the signal which a handful of professional, government, university and commercial users around the world pick up to obtain high resolution digital image data from GOES.

SYSTEM PLANNING

SVAS is transmitted at 1687.1 megahertz. The data stream is modulated onto the carrier as bi-phase modulation (BPSK), 0 and 180 degrees. The data bit rate is 2.11 megabits per second. The spectrum of this kind of a signal is very wide compared to WEFAX. It consists of a broad spread of power between nulls at the carrier frequency +/- N times the bit rate. The carrier fre-

quency is absent from this spectrum. This gives BPSK a high efficiency as power is not wasted in a transmitted carrier. It is necessary to include at least the central "lobe", which is 4.22 MHZ wide, in the receiver bandpass and preferably the first two "side-lobes", which would require 8.44 MHZ, in order to preserve signal quality. Quality, expressed as signal to noise ratio (S/N), is precious in a SVAS system and it must be preserved at every possible point.

The antenna and LNA will determine the feasibility of the entire system. We can do a few calculations, look at the requirements they produce and decide to go on or quit right away. The major problems in duplicating a direct reception VAS system are likely to occur at this "front end". A suitable measure of performance is found in the ratio of antenna gain to equivalent system input noise temperature. Called G/T, this measure can be related to the digital channel bit error rate which describes what we really care about -- data errors. Equation 1 gives the expression for G/T under a given set of channel and transmitter p parameters for the desired bit error rate and equation 2 converts this to the more common decibel form.

$$G/T = (Eb*R*K*L) / (No*EIRP) \qquad 1)$$

$$G/T = Eb/No\ db - EIRP\ dbm - K\ dbm + L\ db + 10 \log R + M\ db \qquad 2)$$

Where:

EIRP = effective isotropic radiated power from GOES
L = path loss at channel frequency
K = Boltzman's constant
Eb/No = energy per bit/channel noise density
R = bit rate
M = miscellaneous loss or "margin" factor

Typical values of these parameters for GOES VAS are:

EIRP = 55 dbm
L = 189.3 db at 1687 Mhz
K = 198.6 dbm
Eb/No = 10.6 db for Pe = 10E-6
R = 2,110,360 bits/sec --> 63.25 db
M = 3 db

These values produce a required value of 12.5 db for G/T. This value may be related to antenna size and LNA performance by making a few realistic assumptions:

a) Antenna noise temperature = 70 K
b) LNA gain and receiver noise temperature are adequate for the LNA to control overall noise temperature.
c) Antenna feed efficiency = .55

Note that M = 3db is the only margin built into the calculation. This is the point of departure from professional systems which would demand at least 10 db and use more conservative values for some of the other parameters. The following table shows how a G/T of 12.5 db can be achieved with common antenna sizes.

Antenna Dia.	Antenna Gain	Maximum System Noise T	Maximum LNA Noise Temp.	Maximum LNAnoise Fig.
24 ft.	40 db	562 K	492 K	4.3db
18	37	282	212	2.4
16	36	224	154	1.8
12	34	141	71	.95
10	32	89	19	.28

Fortunately it is relatively easy to obtain TVRO antennas at modest cost up to 16 feet in diameter. The LNA required for a 10 foot diameter is clearly impractical but 71 degrees, as required for a 12 foot antenna, is within reach of modest cost commercial LNAs. Practical amateur LNA designs would probably fall in the area of 154 degrees and require a 16 foot diameter. Therefore we can conclude that the necessary GOES VAS antenna size is in the range from 12 to 16 feet diameter. Note, however, a subtle assumption in the table: the LNA gain must be high enough to control system noise figure. This means that single stage (typically 14 db gain) designs will normally not be adequate. For example, if the LNA has a noise figure of 1 db (75 deg. K) and a gain of 14 db then when used with a downconverter which alone has a noise figure of 6 db (864 deg. K) the overall noise figure will

be 1.4 db (109 deg. K). This is a degradation of 34 degrees K in noise temperature which could make the difference between good and poor pictures with a 12 foot antenna. A minimum of two stages with at least 22 db gain is required for the LNA to control the overall noise figure with most downconverters.

In summary the GOES downlink requires a 12 foot diameter antenna with a very good LNA or a 16 foot diameter with a modest, single stage, LNA Since GOES is a geostationary satellite, any of the commercial mounts made for TVRO satellites will be quite suitable. The feed horn cannot, of course, be the same as for TVRO. The very same feedhorn designs, however, which have been used for years on WEFAX are inherently wideband designs. They will work as well at 1687 MHZ as for WEFAX at 1691 MHZ.

FEEDHORN AND LNA

It is a difficult job to build an LNA with true noise figure less than 1 db at 1687 Mhz, even for professionals. It was almost impossible ten years ago, and just hard now. (This fact is the main reason most literature assumes amateurs will not be building VISSR or VAS receiving systems. When the GOES system was designed, LNAs of the quality possible now did not exist and it was absolutely necessary to use an antenna of 24 feet diameter or larger. It seemed inconceivable that amateurs would build these).

The best approach is to purchase a suitable LNA. One company, Wilmanco, (19529 Business Center Drive, Northridge California 91324) has available a model 1687LNA for about $700.00. An example of an LNA design which could be home built appears in QST, August 1984, page 65. Another example appears in VHF Communications, Volume 3-1984, pages 130-136. The latter article presents a single stage low noise LNA as well as a two stage design with higher noise. For these designs to be effective, the two separate LNA's should be cascaded ... an approach which could also be used with commercial single stage LNA's such as the Microwave Modules MMG1691. Building and successfully adjusting a 'two' stage LNA is not recommended unless you have specific experience in this area. The LNA should be mounted at the rear of the feedhorn, more than 1 foot of coaxial cable between the antenna feed and the LNA will degrade system noise performance.

***** Additional comments, 18 August 1989: *****

Since this paper was originally written, Greg Ehrler has perfected an LNA design with excellent specifications for this kind of service which can be reliably built by amateurs. The cost is about $100 in parts if all are purchased new and the documentation for construction is quite clear. It achieves between .6 and .8 db noise figure at 36 to 38 db of gain. For details see the Journal of the Environmental Satellite Amateur Users Group: "A Very High Performance LNA for HRPT, VAS, WEFAX and GPS by Gregg Ehrler and John DuBois, Winter 1989, published by Greg Mengell, 2685 Ellenbrook Drive, Rancho Cordova CA 95670.

Published designs for a WEFAX feedhorns for 1691 MHZ, such as the one found in Ralph Taggarts' "Weather Satellite Handbook" can be used for VAS since the bandwidth of these designs is at least 100 MHZ. If local weather is severe, designs using plated steel coffee cans for the cylinder may not be durable unless they are carefully painted to prevent rust. In this case a drawn aluminium can, such as the Zero ZTR-81B, may be easily substituted for the coffee can.

DOWNCONVERTER

Noise figure and gain of the downconverter, while less important than those of the LNA, cannot be neglected completely. Fortunately most WEFAX downconverters are sufficiently broadband that there is no practical difference in input tuning for the VAS signal as compared to WEFAX. A typical input bandwidth is at least 50 MHZ and this will cover both signals easily. The output frequency, however, will not be the typical 137.5 MHZ. The signal from of the downconverter is amplified, filtered to limit the noise bandwidth and fed to a phase detector where the data is demodulated. Therefore the choice of output frequency for the downconverter must be suitable for easy amplification, filtering and phase demodulation. There is considerable latitude in choosing this frequency, it can range from about 10 MHZ to 100 MHZ, but a very convenient choice is 70 MHZ. This is convenient because it is used by many radar, television and digital data systems. Parts such as filters, amplifiers and phase demodulator components are more easily obtained for 70 MHZ than for other possible choices. The downconverter must therefore produce a 70 MHZ output for

1687.1 MHZ input. For homebuilt circuits this is not a difficult design change, simply recalculating the crystal and revising the output amplifier coil or transformer to resonate at 70 MHZ, keeping in mind that the Q should be low enough to allow at least a 6 to 8 MHZ bandwidth. One caution should be noted regarding the choice of 70 MHZ, however. Television broadcast channel 4 occupies the slot between 66 MHZ and 72 MHZ with the picture carrier at 68.25 MHZ. To avoid interference from a strong channel 4, all of the wiring and chassis from the downconverter through the IF amplifier and phase demodulator should be well shielded.

Among commercial downconverters, the Microwave Modules MMK1691/xxxx is a suitable choice in the $350 price class (as of 1988). The xxxx in the model number refers to the IF output frequency. It is usually sold as MMK1691/137.5 with a 137.5 MHZ IF. One of these can be readily modified for 70 MHZ output by changing the oscillator crystal to 89.8333 MHZ, rewinding the two IF output stage coils, and retuning. It can also be ordered, at slightly higher cost, as MMK1691/70 with the modifications already made. Either way the resulting downconverter will have a conversion gain of 25 to 30 db and a noise figure of about 5 db.

With a 13 foot antenna, a feed horn similar to that described, "dead on" pointing of the antenna and correct polarisation of the feed horn, the input to the LNA will be between -105 dbm and -112 dbm. The uncertainty comes from possible differences in antenna and feed efficiency, and other miscellaneous losses. With a 25 db or more gain LNA such as the Wilmanco, and 50 feet or less of good coaxial cable such as RG213, the input to the downconverter will be about -85 dbm. With a 27 db conversion gain, typical of the MMK1691/70, the signal out will be about -58 dbm, centered on 70 MHZ.

IF AMPLIFIER

A 70 MHZ IF amplifier is required to filter and bring this level from -58 dbm up to -10 dbm. There must be reserve for level adjustment so the total gain required is about 60 db. The minimum bandwidth of this amplifier is 4 MHZ at +/- 3 db. The maximum bandwidth should be less than 10 MHZ. There are a number of ways to obtain the IF amplifier. Surplus equipment available will include radar, television distribution, digital radio or TVRO IF strips which can be used with little or no modification. Commercial amplifiers are available with appropriate specifications but can be

very expensive. A third way is to build the amplifier. At 70 MHZ, parts layout is not exceptionally sensitive and with some experience in RF circuits this approach is practical. A suitable design is available from the author.

BPSK DEMODULATOR

The binary data has been modulated onto the carrier as BPSK, zeros are sent with the carrier phase unchanged while ones are sent with the carrier phase shifted 180 degrees. In order to build a practical phase detector it is necessary to have a replica of the exact carrier frequency, however the spectrum of the received BPSK signal has no component at the center to define this carrier frequency. An ordinary phase locked loop, for example, cannot be used since there is no carrier for it to lock onto. A number of circuits been devised to deal with this problem and all depend on some kind of nonlinear operation on the signal to regenerate the carrier. For example, squaring will produce a component at twice the carrier frequency which can be divided by two to yield the desired signal. For VAS use, a good circuit choice is the Costas Loop which is a variation on a phase locked loop that compensates for phase reversals of the carrier.

The input signal is split into two channels and multiplied by the local voltage controlled oscillator at zero and ninety degrees phase shift. The baseband output of the mixers is filtered with a cutoff just above the data rate. The two channels are then multiplied together and the output fed as correction voltage to the VCO. Demodulated data appears at one of the lowpass filter outputs and frequency error appears at the other. The loop operation can be understood by thinking of the data input to the VCO multiplier as reversing the correction phase at the proper times to be in step with the carrier phase reversals and fooling the VCO into behaving as an ordinary PLL. The output from this circuit is the VAS data stream at 2.11 MBPS. If you examine it with a non-storage scope, successive lines will overlay and you will see the superposition of ones and zeros, commonly called an "eye" pattern. The degree to which the center part of the eye is clean and free of any out-of-place transitions is a measure of S/N. For successful VAS pictures, the eye must be at least 80% open, hopefully more.

BIT SYNCHRONIZER

The VAS data stream contains the data and clock multiplied together to increase the transmission efficiency. Reversing the process to separate data and clock, however, is not so simple because after the multiplication we don't know readily whether a particular transition belongs to the clock or the data. It is only in the longer term (many bit times) that we can be sure that there have been on average, R, clock transitions where R is the clock rate.

The fact that on average the bit stream carries a constant clock rate, is the clue to clock recovery. If we feed the bit stream through an nonlinear circuit such as a differentiator we will regenerate spectrum lines at the clock rate and its multiples. By filtering out the fundamental and feeding this to a PLL the pure clock can be recovered if the bandwidth of the PLL is set low enough to suppress phase jitter from the "random" data transitions.

FRAME SYNCHRONIZER

Once the separated clock and data are obtained at the output of the bit synchronizer, the processing becomes entirely digital. However, the high bit rate, 2.11 MBPS, and the requirement to locate specific patterns in the data stream to identify image boundaries precludes feeding the data directly into a personal computer serial data port. Even "turbo" speed PC's would not be able to ingest this data and separate telemetry from image bytes at the required rate. Fortunately the task can be done simply in dedicated hardware and provide organised image data to the PC from memory mapped onto its own data bus.

The basic frame of stretched VAS data is organised as 12 blocks, each lasting 50 milliseconds. This entire frame, which takes 600 milliseconds, is transmitted during one revolution of the satellite spinning at 100 rpm. The beginning of each block is identified by a unique 10,032 bit pattern in the data. The frame synchronizer must identify a fragment (or all) of this pattern precisely and then use the identification time as a reference point from which to count out bits and words representing the desired images. Several methods exist for identifying this initial block synchronisation word. Digital correlation by integrated circuits such as the TRW 1023 is straightforward but expensive. The method used in the circuit designs available from the author is to compare the ongoing data bit stream with the output of a PN sequence generator which

itself produces the synchronising pattern. If there is a mismatch, the local generator is restarted. Eventually there will be coincidence between the two patterns and when they have run together to the end of the sequence, a flag is set for other circuits to begin operating. The local generator is allowed to continue running because the data must be multiplied by this sequence to remove a randomising function imposed at the transmitter.

The organisation of data in the 12 blocks of each line is described in the NOAA/NESDIS publication "Operational VAS Mode AAA Format, Specification SFP 002 - Version 2.2". Each block consists of a general information header giving the block number and other details, and an information field containing image documentation and the image data itself. The frame of 12 blocks contains data for 1 line of infrared image in two different spectral bands and data for 8 consecutive lines of visible spectrum image. There are 3822 ten bit image words in the infrared blocks and 15,802 six bit image words in the visible spectrum blocks. The documentation fields of these blocks contain a wealth of information for calibration, gridding, location of the field of view, orbit parameters, and so forth. There is so much information, not to mention so many image words, that the primary design task for a low cost system is deciding what to eliminate. The principle technique for simplifying the reception hardware and lowering its cost is to select a small portion (512 bytes) of the incoming data which is adequate for the users purposes and saving only that portion in a cache RAM. At the end of the block there is adequate time to transfer this cache into the associated personal computer. The cache interface hardware is configurable for selection parameters, mainly the number of consecutive image words to skip, so that different geographic coverage can be achieved. By saving only every 30th image word for example, the entire width of the full globe can be displayed in a 512 byte image line. The actual resolution in this image would be quite low, of course, but when smaller geographic areas are desired, fewer image words are omitted and the resolution is approximately matched to the field of view.

The design of the cache RAM and associated timing hardware will be highly specific to the personal computer selected for data handling and display. Circuits are available from the author for one such design intended to work with the common XT class computer. This interface maps the temporary cache storage into the XT memory space and issues interrupts at the beginning and

end of each data block. The beginning interrupt allows identification of the block and a decision on keeping or skipping that block. If it is to be kept, the data is transferred out of the local memory following the subsequent interrupt and directly into the image frame buffer memory for immediate display of the line. This technique avoids any requirement for extended memory on the main computer bus. Timing parameters are set up through several I/O ports on the interface. In addition to image data, the general information telemetry available in the IR blocks 1 and 2 is extracted, displayed and updated on the XT computer screen once per line.

High speed operation of the computer is not a prerequisite. The authors system operates at the lowest common clock speed, 4.7 MHZ, and adequate time is available for collecting 512 data bytes per image line and transferring them to the display memory.

FRAME BUFFER

As in the choice of computer, the choice of a frame buffer for video image display is wide. The conventional CGA and EGA display cards are not suitable for the purpose because their resolution and grey scale are too restricted for satisfactory VAS images. Some of the recent "Super" VGA displays will provide 640 pixels x 480 lines at 256 colours or 64 grey shades which is adequate for many uses. Another satisfactory solution at somewhat higher cost is to use an "image processing" type frame buffer card available from several manufacturers for both XT and AT class computers. The minimum configuration of these buffers is 512 pixels x 512 lines at 256 grey shades and a typical example is the TARGA model M8 in the $2000 price class. This is entirely satisfactory for monochrome VAS image display and allows experimentation with colour representation of albedo.

The final consideration in the low cost system assembled around the XT or similar personal computer is longer term storage of the images. The technique described stores the image in the local memory of the frame buffer while it is viewed. If it is to be saved it can be transferred out of the frame buffer onto fixed disk or floppy disk. One 512 x 512 image will require 225K of storage space but this can be reduced by any of the popular "archive" data compression programs to about 150K.

An Interface Program in 'C'
For the YU3UMV Framestore to IBM Personal Computer

by: David Juett, G1TPV

The articles in VHF Communication (3/1987, 3/1988) by Hans Opperman, Quickborn have a few errors in circuit and software. Here is a corrected version of the circuit (reproduced as a centre-fold) and a program written in 'C' to allow you to save and load framestore pictures to and from disc. The source code and necessary assembly code object modules are provided. They are intended to be used on Borland Turbo C version 2.

The circuit was constructed using wire-wrap on a RadioSpares IBM prototyping card, stock number 435-686. (Ask for a data sheet with it). No problems were encountered except that the frame store does not like data sent to it too quickly. I found that the serial chip would run happily with a 6MHz crystal but that there needs to be a modest delay between bytes sent. The actual crystal frequency is not important as the circuit generates the necessary clocks and delayed strobe. 4.4 to 5MHz is fine. To allow the use of one start and one stop bit instead of the framestores no start and 2 stop bits, you MUST CONNECT I108 pin 4 to ground. This will not affect the normal framestore operation. You also need to unground PT116 (use a 10K to ground for when the link is disconnected) and use it as R/W control.

The program is invoked by 'PICIOHX' at the C:> prompt. After a version message and information on the memory space available to store the WEFAX picture (as an array of 400x256 bytes needs 102400 bytes on disc), it offers:-

I
to input a picture - do wait until the current picture has finished as it expects to read 400 lines of picture. You can press I before the picture starts - it will wait for it. You can hit any key while its reading to abort the operation, but not when there is no input signal.

O
will output the current contents of the picture buffer in about 15 secs for a full screen and 24 secs for the whole picture. There is no abort provided.

G
Will generate a simple 64 level greyscale test pattern. Any key stops it.

R
releases the frame store to continue reading in pictures from the satellite.

L
asks for a filename to load a picture from. Two examples are on disc as TEST0 and TEST2 - both are Africa to England visual E2s.

S
asks for a filename to save the current picture in memory to. (Put into memory by the 'I' command).

W
will freeze the incoming picture on the framestore.

Q
Quits back to MSDOS - remember to use R to release the frame store.

The program in PICIOHX.C contains information on the registers of the SCN2661 and a reasonable amount of comment. The main problem was how to obtain access to the 100K or so of RAM needed for the picture store without compiling under the HUGE model. The program is in fact compiled with the SMALL model but uses HUGE pointers together with custom routines write_pic() written in assembler and far_write() written using inline assembly code.

This is a rather basic package but it may be of interest to people experimenting with data transfer between framestore and IBM type computers.

The Disc contains:-

```
ASMRULES H        4459  19-01-88   1:05a used in tcc -c farwrite
FARWRITE OBJ       316  15-08-89   1:34p needed to link piciohx.exe
FARWRITE C         487  30-05-89   1:08p use tcc -c farwrite to assemble
NEW      LIB      5503  10-05-89   4:48p ORCAD library for circuit
PICIO    PLT     26418  15-08-89   1:01p HP plotter file for circuit
PICIO    SCH      4983  15-08-89  11:01a ORCAD circuit file
```

```
PICIOHX  PRJ       42  30-05-89   1:09p Project file for compilation
PICIOHX  EXE    23453  30-05-89  10:46p Working program
PICIOHX  C       8848  30-05-89  10:45p Source of main program
TESTO          102400  30-05-89   2:33p Weather picture
TEST2          102400  15-08-89   2:04p Same on another day
WRITEPIC ASM     1476  30-05-89   7:31p
WRITEPIC OBJ      289  30-05-89   7:31p needed to link piciohx.exe
```

David Juett has kindly donated the above to the RIG.

This disc containing the above software is available from the editor/secretary on 5.25 or 3.5 DD disc for the sum of £6.50 , including UK postage and packing. Cheques payable to Remote Imaging Group. It is supplied on the understanding that it supplied for strictly non-commercial use by RIG members.

WEATHERTRAC - A Review

by Stephen Pedar
Sarasota
Florida, USA.

This is an evaluation of the new IBM PC based satellite image acquisition and animation system. I know that some of the readers have expressed an interest in such a system. It is marketed under the name of Weathertrac and is based on a IBM PC/XT/AT.

The system includes an audio decoder/interface, data acquisition card, enhanced VGA and graphics board and the software with the manual. The system is capable of 640 x 480 x 256/256K colours. It displays 64 grey scale which is the limit of resolution of the human eye. It will also display 1024 x 768 x 16/256K colours.

My system includes a quadrifiler helix omnidirectional antenna with pre-amp, a directional antenna with pre-amp, and a 2 meter dish antenna for the GOES satellite reception. The receiver is a Dartcom satellite receiver. This drives the Weathertrac system. The computer is an IBM clone with the 80386 board running at 25 MHz, 4 Mb 100ns RAM, an 80 MB hard disk, 1.44 Mb 3.5" and 1.2 Mb 5.25" floppy discs, and 120 Mb tape drive.

The directional antenna is aimed by the Sat Track II computer controller which drives a Kenpro 5400A Az/El rotor. The pointing accuracy of this is +/- 3 degrees.

Both the Dartcom receiver and the Sat Track II controller have a relay capable of triggering the Sony Walkman recorder. This is a great help since it allows unattended acquisition of polar satellite pictures. Since I started using this system, I have been able to obtain one or more satellite pictures daily. There is insignificant degradation of the picture quality when viewed from the tape.

The images are received directly form the radio by the Weathertrac system or indirectly from the tape recorder. They are then stored on the hard disc and can be archived on the computer tape drive. A typical NOAA pass covering some 1000 miles requires over 500 Kb of disc space storage. The images can also, of course, be stored on floppy disk. Post reception enhancement of the images is possible with 9 linear, 4 logarithmic, and 4 exponential scales. False colour enhancement via a mouse driven palette is also possible. In

addition, images can be enhanced via 20 built in NOAA/NESDIS IR image enhancement curves.

The program supports hardware pan and zoom, allowing enlargement of any segment of the picture to a variable extent. In addition, the program also supports histograms of any area of the picture, filtering, 3D projections, statistics, and AVHRR/APT automated temperature calibration. This allows one to zoom in on a NOAA pass and examine any area of interest in great detail. Since I lived in the Gulf of Mexico, the loops of the gulf stream, become quite obvious especially during the winter months.

This program allows loop animation with 4 pictures/MB of expanded RAM. This allows one to watch the relentless march from the fronts across the country. This is most useful when using successive GOES images of the same quadrant.

Changing the acquisition rate to 214 allows one to copy the 20 line per minute Meteor IR images transmitted during darkness.
This system is the most versatile method of receiving weather satellite images. It allows unattended operation, the storage and retrieval of the images, and their manipulation to enhance certain features. Since the system is software driven, future enhancements can be easily incorporated. The basic IBM computer, can also be used for other tasks including satellite orbit predictions. Hopefully, in the near future, a board shall become available for this computer allowing one to copy the digital HRPT pictures.

The great advantage of the system is its simplicity. It allows me to automatically copy polar orbiting weather satellites and GOES images. My omnidirectional antenna is able to receive excellent images from Nicaragua to Canada. There is no need for orbital predictions since the Dartcom receiver is ready to receive all the time at the specified frequency. I do not use the scanning feature since it opens the squelch frequency causing it to trigger the recorder and filling the tape with noise.

When I return home from work, the images are ready to be copied to the hard disc and manipulated with the software program. The one weakness of the system is the lack of hard copy output. I was unable to find a RGB converter board that allows one to output the picture to the Mitsubishi video printer.

I have used a video camera trained on the screen of the IBM

monitor and have copied the pictures to the video printer in this manner with acceptable results. I have also digitised the pictures from the IBM monitor via a video camera and copied them onto a Mac 11 and then printed them on the laser printer. Since the printer has no grey scale the results are less than satisfactory. The best method of producing hard copy is to merely photograph the screen with a camera. I use a black and white film and a 35mm camera with a close up lens. The aperture is set on f 16 resulting in good depth of field. This has to be done in a darkened room since reflections can spoil the picture.

METEX 89 by Dick Boardman

Products and services for Meteorology, Hydrology and Oceanography

This trade exhibition was held at Reading University on 7th-8th August. It covered a wide range of products. There were devices for measuring wind speed and direction, temperature, humidity and water level. Many of these devices would function unattended for long periods and report their results by phone or radio.

The interesting items from the point of view of RIG members were the weather satellite Picture Reception systems. These were of very high quality and (in some cases) very high price. This review is not for the benefit of the very few millionaire RIG members but rather to give us all some idea of what we will be able to buy in a few years time.

Since this was a professional exhibition the emphasis was on the uses of satellite pictures eg measurement of vegetation coverage, detection of pack ice, measurement of cloud temperature, measurement of sea temperature and so on. The displaying of pretty pictures was confined to the educational market.

All the exhibits were computer based and the more expensive the computer the better the pictures. This is what makes me hope that the price will come down since the cost of memory and computer power has been decreasing steadily for some years and shows no sign of stopping yet.

The difference between professional and the amateur systems showed in the displays, which were sharp and flicker free, and in the software. Several systems offered the ability to zoom in onto areas and to optimise grey levels. Some could combine several pictures so that maps or place names could be over laid on to the basic picture. All weather satellite pictures are really black and white but some systems could colour in different areas and this is greatly enhanced the results.

Hard copy output was available too, though still expensive. This is an area where amateurs (except for photographic experts) really miss out.

The best exhibit was a German system made by UKW Technik. It received primary (high resolution digital) signals from Meteosat and displayed them on a DIGISCAN computer system. The pictures were exceptionally clear and sharp and the digital values could be used directly for measurements. They also offered two graphics printers, a colour one, and a black and white one.
The quality of the black and white printer was not far off photographic quality.

The Macsat system, made by Dartcom, that was shown on the RIG stand at Sandown Park, was on display, offering excellent pictures on an Apple MacIntosh computer.

TimeStep showed a system based on an IBM PC, which showed a sequence of 16 Meteosat pictures, all 640 * 400 pixels with 64 or 256 grey levels. It is nearly as good as a T.V. picture.

British Aerospace were also offering a pc based system, again using Dartcom equipment.

The Royal Meteorological Society had a stand and was advertising the joint meeting with the RSGB on the 28th October 1989. Our Chairman, Henry Neale, is giving a lecture. All loyal RIG members should attend.

THE RUSSIAN SATELLITE SCENE
by Les Currington

In the view of the present period of space inactivity it might be as well to show the prints of two recent Soviet achievements.
In the centre page you should find two interesting prints; one showing the IR of Meteor 3/02 and the second Okean.

Meteor 3/02

It may do well to reflect on the Meteor 3/02 series of weather satellites; 3/02 was placed in a 250 Km higher orbit than the Meteor 2 series so as to give greater global coverage the IR scanner is able to determine the temperature of the earth "to within a degree" and for the first time it was also revealed that an ozone measuring device was on board.
The centre print shows Hurricane Helien off the north of Scotland and an almost clear view of UK except, for a small storm near the Isle of Wight.

Okean

No signals have been heard from this oceanographic Satellite for some considerable time, so I thought it a good idea to show members one of the excellent pictures received during the early testing during July 1988; the print shows a complete format of an Okean transmissions consisting of visible, radar and microwave scanner covering the well known pass across central Europe.

Weather satellite report as at 28th August 1989:

Meteor 2/16

Meteor 2/16 has moved into a mid morning ascending orbit and continues to give imagery: by the time you read this report the early morning pass should be switching to IR.

Meteor 2/17

Meteor 2/17 is now in a north Atlantic early morning pass and will soon be out of range of UK; however the first orbits in range are now appearing over Eastern Europe on an ascending pass and around 17 00 hrs was giving very good pictures of storms over Europe.

Meteor 2/18

Meteor 2/18 continues to give excellent pictures on a mid morning near overhead ascending pass.

Meteor 3/02

Meteor 3/02 is now in a position to give superb pictures of Greenland. At 14 30 GMT on the 16-8-89 one of the best passes I have seen was recorded, covering an area from the South of Greenland up to the North Pole; this will now go into my tape library for future printing.

KEPLER ELEMENTS provided by Max White

ROYAL GREENWICH OBSERVATORY, HERSTMONCEAUX CASTLE

	NOAA 9	MET 2-17
	137.62 MHz	137.30 MHz
	84-123 A	88-05 A
EPOCH OF DATA	89230.913459	89232.002632
ACCELERATION	0.00000790	0.00000110
REV NO	24130	7851
INCLINATION	99.148	82.540
R. A. NODE	219.103	229.833
ECCENTRICITY	0.001593	0.001850
ARG OF PERIGEE	134.506	89.038
MEAN ANOMALY	225.741	271.290
MEAN MOTION	14.1212484	13.8419028

	MET 3-02	NOAA 11	NOAA 10
	137.3 MHz	137.62 MHz	137.50 MHz
	88-64 A	88-89 A	86-73 A
EPOCH OF DATA	89231.787165	89231.877675	89231.572727
ACCELERATION	0.00000391	0.00000625	0.00000691
REV NO	5128	4645	15295
INCLINATION	82.547	98.942	98.636
R. A. NODE	130.681	175.605	260.856
ECCENTRICITY	0.001648	0.001333	0.001467
ARG OF PERIGEE	352.008	54.871	68.401
MEAN ANOMALY	8.075	305.371	291.872
MEAN MOTION	13.1685726	14.1110754	14.2312970

	MET 2-18	MET 2-16
	137.3 MHz	137.4 MHz
	89-18	87-68 A
EPOCH OF DATA	89232.040440	89231.838142
ACCELERATION	0.00000117	0.00000218
REV NO	2391	10131
INCLINATION	82.527	82.558
R. A. NODE	108.396	169.110
ECCENTRICITY	0.001490	0.001374
ARG OF PERIGEE	124.840	23.520
MEAN ANOMALY	235.416	336.660
MEAN MOTION	13.8383130	13.8350136

Reference Orbits for Russian Satellites
supplied by Dick Boardman
These are the times of north going equator crossing (in GMT) and longitudes (in degrees west) for four Russian satellites.
They are given at weekly intervals together with the period and the change in longitude per orbit.

MET 2-16 134.4
Period 104.142 minutes increment 26.21 degrees

10SEP 11:06 3	17SEP 9:43 355	24SEP 10:05 13
01OCT 08:42 4	08OCT 07:20 356	15OCT 7:42 14
22OCT 06:19 6	29OCT 4:75 358	05NOV 05:19 15
12NOV 3:57 7	19NOV 2:35 359	26NOV 2:56 17
03DEC 01:34 9	10DEC 0:11 0	17DEC 0:34 18
23DEC 23:11 10	30DEC 21:48 2	06JAN 22:1O 20

MET 2-17 173.3
period 104.091 minutes increment 26.09 degrees

10SEP 14:47 358	17SEP 15:03 15	24SEP 13:36 5
10OCT 12:09 355	08OCT 12:26 12	15OCT 10:58 3
22OCT 11:15 19	29OCT 09:48 10	05NOV 8:20 0
12NOV 8:37 17	19NOV 7:10 8	26NOV 5:43 358
03DEC 5:59 15	10DEC 4:32 5	17DEC 3: 5 356
24DEC 3:22 12	31DEC 1:54 3	07JAN 2:11 20

MET 2-18
period 104.122 minutes increment 20.26 degrees

10 SEP 07:08 4	17 SEP 5:44 355	24 SEP 06:03 13
10 OCT 04:38 4	08 OCT 3:13 355	15 OCT 03:33 12
22 OCT 02:09 3	29 OCT 0:44 355	05 NOV 01:03 12
11 NOV 23:39 3	18 NOV 23:58 21	25 NOV 22:33 12
02 DEC 21:09 3	09 DEC 21:28 20	16 DEC 20:04 11
23 DEC 18:38 3	30 DEC 18:57 20	06 JAN 17:33 11

MET 3-02 137.3
Period 109.407 minutes increment 27.46 degrees

10 SEP 08:45 5	17 SEP 08:31 13	24 SEP 08:17 21
10 OCT 06:13 2	08 OCT 05:59 10	15 OCT 05:45 18
22 OCT 03:40 359	29 OCT 03:27 7	05 NOV 3:12 15
12 NOV 01:07 356	19 NOV 00:54 4	26 NOV 00:39 13
03 DEC 0:25 21	09 DEC 22:21 2	16 DEC 22:07 10
23 DEC 21:52 18	30 DEC 19:49 359	06 JAN 19:34 7

ABBREVIATIONS USED IN METEOSAT IV SCHEDULE IN RIG 17:

ADMIN
Administration message, normally advising what images were not disseminated (sent).

TEST
Test Cards: They contain grey scales which are very useful for the WEFAX user to check the number of grey levels his system is displaying

DTOT	Whole Earth Disc - Infra-red
CTOT	Whole Earth Disc - Visible light
ETOT	Whole Earth Disc - Water vapour

D1 D2 D3 D4 D5 D6 D7 D8 D9
Views of the Earth in a 3x3 matrix, D1 is top left etc All are Infra-red

C1D C2D C3D C4D C5D C6D C7D C8D C9D
Same matrix as Dn series above but in the Visible light spectrum

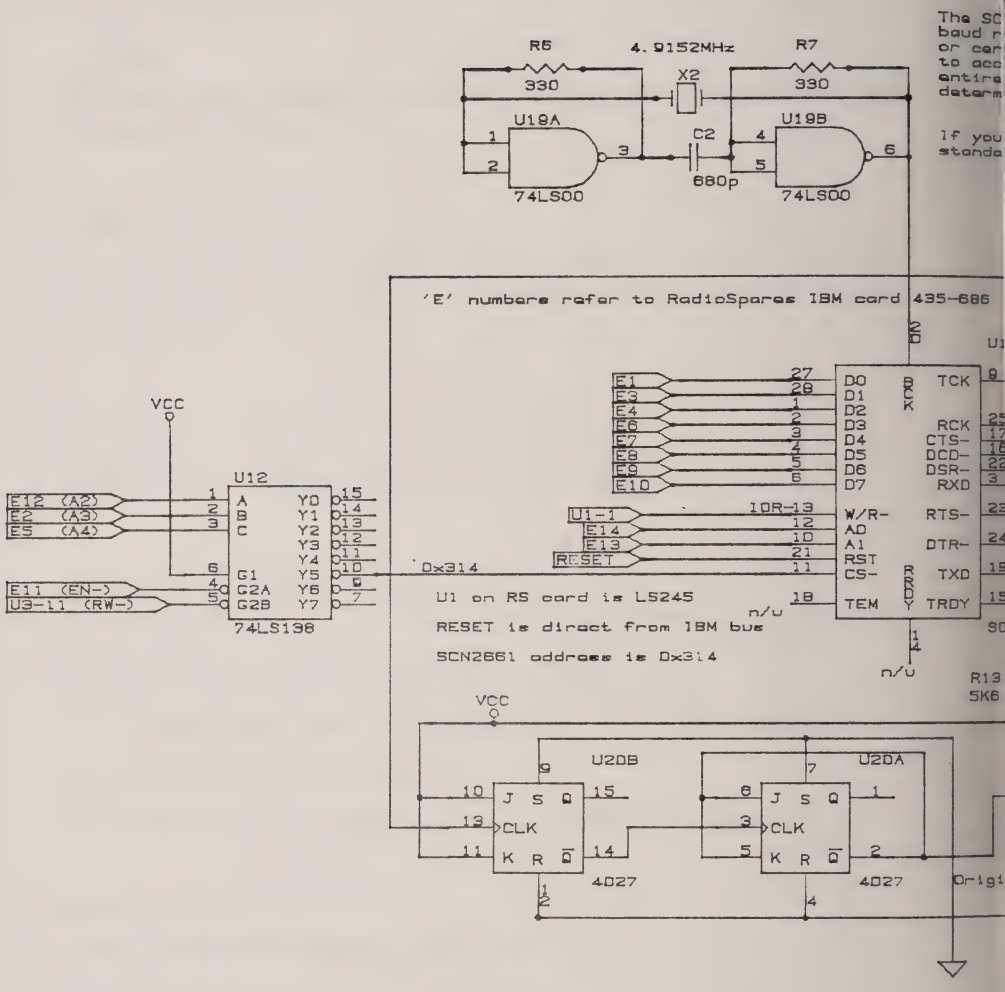
E1 E2 E3 E4 E5 E6 E7 E8 E9
Same matrix as Dn series above but in the Infra-red spectrum.

WEFA
These are weather maps used in aviation.

C01 C02 C03 C04..... UP TO C24.
Visible images of Earth, this time divided up into 24 smaller squares for more detail. Only C02 & C03 in current schedule as they cover Western Europe (one each side of the Grenwich Meridian).

CTH
Cloud Top Heights, a whole disc image like CTOT but with a 6 step grey scale to indentify the maximum heights of clouds.

continued on page 69

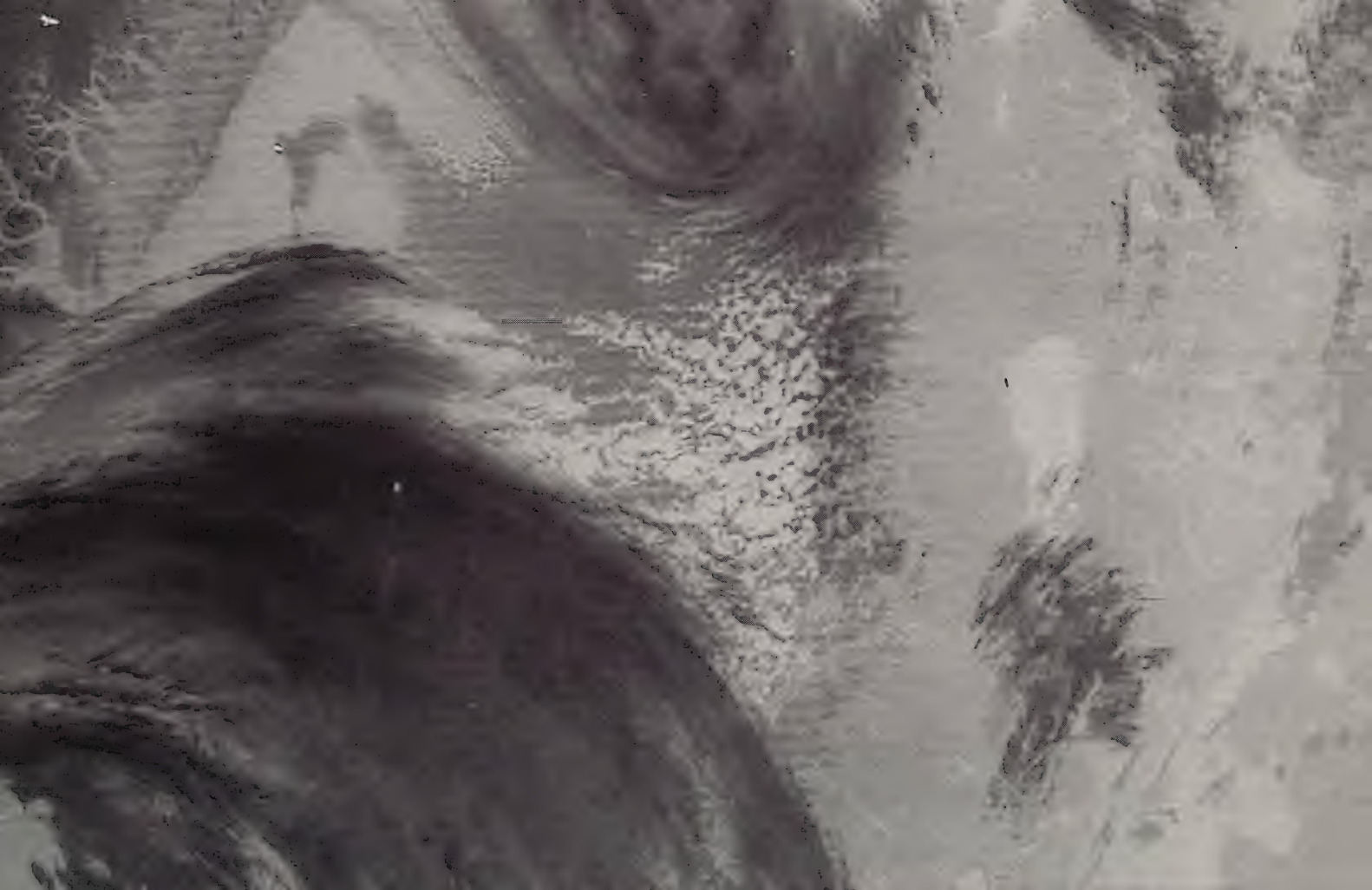


This circuit is a corrected version of on

that appeared in VHF Communications, Vol.

The circuit is wire wrapped on a RadioSpa

and has been tested in XT and AT clones.



For Sale -- Photocopier --

-- Nashua 1250 --

A3 B4 A4 etc. Working order
30 pounds Buyer collects
Chairman tel. 094585353

NOAA 10:

1/10 182 07:38 30/10 347 18:38 27/11 341 18:11 24/12 341 18:07
1/10 334 17:46 31/10 190 08:08 28/11 184 07:41 25/12 183 07:37
2/10 353 19:04 31/10 342 18:15 28/11 336 17:48 25/12 335 17:44
3/10 348 18:42 1/11 184 07:45 29/11 330 17:26 26/12 330 17:21
4/10 190 08:12 1/11 336 17:52 29/11 355 19:07 26/12 355 19:03
4/10 342 18:19 2/11 330 17:30 30/11 350 18:44 27/12 349 18:40
5/10 184 07:49 3/11 350 18:48 1/12 344 18:22 28/12 344 18:17
5/10 336 17:57 4/11 344 18:26 2/12 186 07:51 29/12 186 07:47
6/10 331 17:34 5/11 187 07:56 2/12 338 17:59 29/12 338 17:55
7/10 350 18:52 5/11 339 18:03 3/12 181 07:29 30/12 332 17:32
8/10 345 18:30 6/11 181 07:33 3/12 333 17:36 31/12 352 18:51
9/10 187 08:00 6/11 333 17:40 4/12 352 18:55 1/01 346 18:28
9/10 339 18:07 7/11 353 18:59 5/12 347 18:32 2/01 189 07:58
10/10 182 07:37 8/11 347 18:36 6/12 189 08:02 2/01 341 18:05
10/10 333 17:45 9/11 190 08:06 6/12 341 18:10 3/01 183 07:35
11/10 353 19.03 9/11 341 18:14 7/12 184 07:39 3/01 335 17:43
12/10 348 18:40 10/11 184 07:44 7/12 335 17:47 4/01 355 19:01
13/10 190 08:10 10/11 336 17:51 8/12 330 17:24 5/01 349 18:39
13/10 342 18:18 11/11 330 17:28 8/12 355 19:05 6/01 343 18:16
14/10 184 07:48 12/11 350 18:47 9/12 350 18:43 7/01 186 07:46
14/10 336 17:55 13/11 344 18:24 10/12 344 18:20 7/01 338 17:53
15/10 331 17:32 14/11 187 07:54 11/12 186 07:50 8/01 332 17:31
16/10 350 18:51 14/11 339 18:02 11/12 338 17:57 9/01 352 18:49
17/10 345 18:28 15/11 181 07:32 12/12 181 07:27 10/01 346 18:27
18/10 187 07:58 15/11 333 17:39 12/12 333 17:35 11/01 189 07:57
18/10 339 18:06 16/11 353 18:58 13/12 352 18:53 11/01 341 18:04
19/10 181 07:36 17/11 347 18:35 14/12 347 18:31 12/01 183 07:34
19/10 333 17:43 18/11 189 08:05 15/12 189 08:01 12/01 335 17:41
20/10 353 19:02 18/11 341 18:12 15/12 341 18:08 13/01 355 19:00
21/10 347 18:39 19/11 184 07:42 16/12 183 07:38 14/01 349 18:37
22/10 190 08:09 19/11 336 17:50 16/12 335 17:45 15/01 343 18:15
22/10 342 18:16 20/11 330 17:27 17/12 330 17:23 16/01 186 07:45
23/10 184 07:46 20/11 355 19:08 17/12 355 19:04 16/01 338 17:52
23/10 336 17:54 21/11 350 18:46 18/12 349 18:41 17/01 332 17:29
24/10 330 17:31 22/11 344 18:23 19/12 344 18:19 18/01 352 18:48
25/10 350 18:50 23/11 187 07:53 20/12 186 07:49 19/01 346 18:25
26/10 345 18:27 23/11 338 18:00 20/12 338 17:56 20/01 189 07:55
27/10 187 07:57 24/11 181 07:30 21/12 181 07:26 20/01 340 18:03
27/10 339 18:04 24/11 333 17:38 21/12 332 17:33 21/01 183 07:33
28/10 181 07:34 25/11 353 18:56 22/12 352 18:52 21/01 335 17:40
28/10 333 17:42 26/11 347 18:34 23/12 346 18:29 22/01 355 18:59
29/10 353 19:00 27/11 189 08:03 24/12 189 07:59 23/01 349 18:36

NOAA 11:

1/10 354 13:29 30/10 354 13:28 29/11 352 13:17 29/12 349 13:05
2/10 352 13:18 31/10 352 13:17 30/11 349 13:06 30/12 346 12:55
3/10 349 13:08 1/11 349 13:07 1/12 346 12:55 31/12 344 12:44
4/10 346 12:57 2/11 346 12:56 2/12 344 12:45 1/01 188 02:21
5/10 190 02:34 3/11 344 12:46 3/12 188 02:22 1/01 341 12:33
5/10 344 12:46 4/11 188 02:22 3/12 341 12:34 2/01 185 02:10
6/10 188 02:23 4/11 341 12:35 4/12 185 02:11 2/01 338 12:23
6/10 341 12:36 5/11 185 02:12 4/12 338 12:24 3/01 183 02:00
7/10 185 02:13 5/11 338 12:24 5/12 183 02:00 3/01 336 12:12
7/10 338 12:25 6/11 183 02:01 5/12 336 12:13 4/01 333 12:02
8/10 183 02:02 6/11 336 12:14 6/12 333 12:02 5/01 331 11:51
8/10 336 12:15 7/11 333 12:03 7/12 330 11:52 6/01 353 13:23
9/10 333 12:04 8/11 330 11:53 8/12 353 13:23 7/01 351 13:12
10/10 330 11:53 9/11 353 13:24 9/12 351 13:13 8/01 348 13:01
11/10 353 13:25 10/11 351 13:14 10/12 348 13:02 9/01 345 12:51
12/10 351 13:14 11/11 348 13:03 11/12 345 12:52 10/01 190 02:28
13/10 348 13:04 12/11 345 12:52 12/12 190 02:28 10/01 343 12:40
14/10 345 12:53 13/11 190 02:29 12/12 343 12:41 11/01 187 02:17
15/10 190 02:30 13/11 343 12:42 13/12 187 02:18 11/01 340 12:30
15/10 343 12:43 14/11 187 02:19 13/12 340 12:30 12/01 184 02:06
16/10 187 02:19 14/11 340 12:31 14/12 184 02:07 12/01 338 12:19
16/10 340 12:32 15/11 184 02:08 14/12 338 12:20 13/01 182 01:56
17/10 184 02:09 15/11 338 12:21 15/12 182 01:57 13/01 335 12:08
17/10 337 12:21 16/11 182 01:57 15/12 335 12:09 14/01 332 11:58
18/10 182 01:58 16/11 335 12:10 16/12 332 11:59 15/01 330 11:47
18/10 335 12:11 17/11 332 11:59 17/12 330 11:48 15/01 355 13:29
19/10 332 12:00 18/11 330 11:49 17/12 355 13:30 16/01 353 13:19
20/10 330 11:50 18/11 355 13:31 18/12 353 13:20 17/01 350 13:08
20/10 355 13:32 19/11 352 13:20 19/12 350 13:09 18/01 347 12:58
21/10 352 13:21 20/11 350 13:10 20/12 347 12:58 19/01 345 12:47
22/10 350 13:11 21/11 347 12:59 21/12 345 12:48 20/01 189 02:24
23/10 347 13:00 22/11 345 12:49 22/12 189 02:25 20/01 342 12:36
24/10 345 12:49 23/11 189 02:25 22/12 342 12:37 21/01 186 02:13
25/10 189 02:26 23/11 342 12:38 23/12 186 02:14 21/01 339 12:26
25/10 342 12:39 24/11 186 02:15 23/12 339 12:27 22/01 184 02:03
26/10 186 02:16 24/11 339 12:27 24/12 184 02:03 22/01 337 12:15
26/10 339 12:28 25/11 183 02:04 24/12 337 12:16 23/01 181 01:52
27/10 183 02:05 25/11 337 12:17 25/12 181 01:53 23/01 334 12:05
27/10 337 12:18 26/11 181 01:54 25/12 334 12:05 24/01 331 11:54
28/10 181 01:54 26/11 334 12:06 26/12 331 11:55 25/01 354 13:26
28/10 334 12:07 27/11 331 11:56 27/12 354 13:26 26/01 352 13:15
29/10 331 11:56 28/11 354 13:27 28/12 352 13:16 27/01 349 13:04

DETAILS OF NOAA PREDICTIONS:

NOAA '10'
PERIOD 101.2391998583287 MINUTES
INCR 25.31150303102917 DEGREES

All morning passes are southbound, evening passes are northbound.

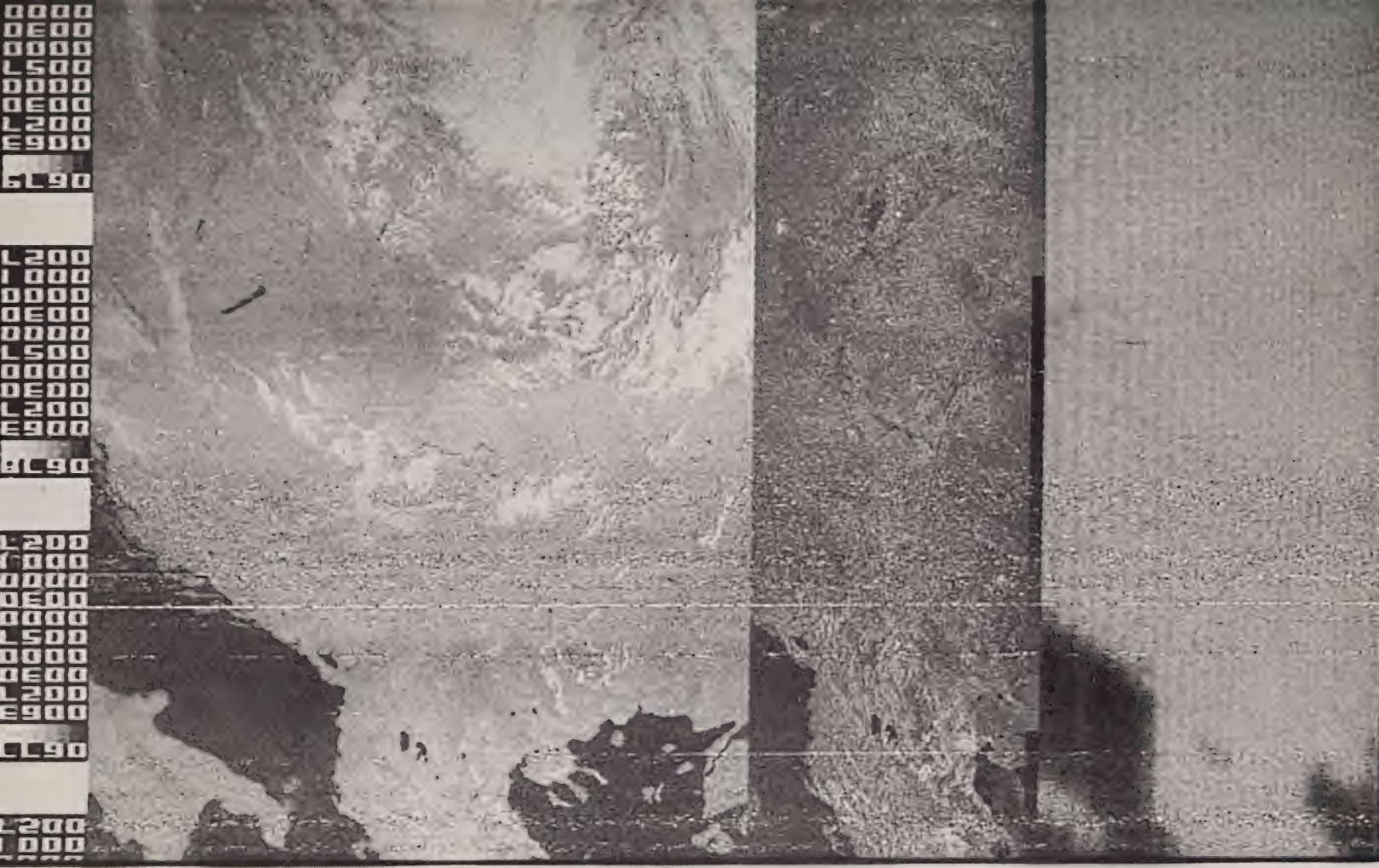
Frequency 137.50MHz. INCRement is degrees change per orbit.

NOAA '11'
PERIOD 102.1007690429688 MINUTES
INCR 25.52574920654297 DEGREES

All morning passes are southbound, afternoon passes are northbound.

Frequency 137.62MHz. INCRement is degrees change per orbit.

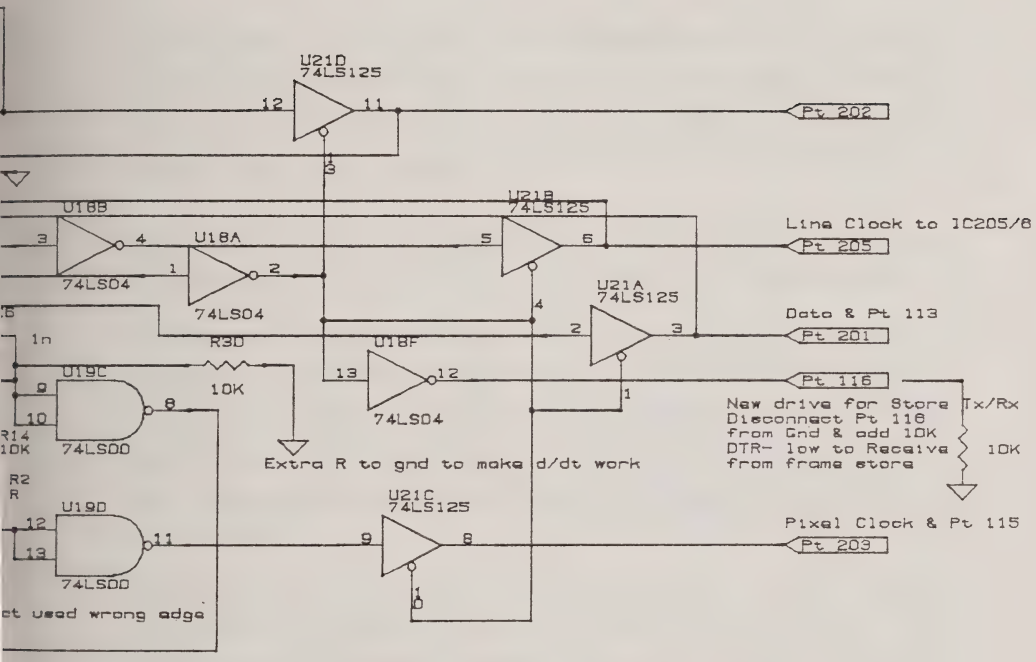
Eds Note: Apologies for the wavy columns in the predictions, I'm still trying to find a way to put the TABS in automatically in the data



Italy VISIBLE | Radar | microwave scanner

type B uses 4.9152 xtal for standard
up to 38400. It will work with a 8MHz xtal
device. WARNING the Store becomes unable
ata at high rates without missing
ure lines. Delay between bytes to
he max baud rate, then reduce delay.

an SCN2651 (pin compatible) the
al is 5.0688MHz and max baud rate 19200



You might like to add additional lines
to detect start/stop tones or select
memory banks etc.

y Hans Opperman, Quickborn

, Autumn 1987

IBM proto card 435-686

Title: IBMPC Serial Interface to YU3UMV Frame Store		
Size: B	Document Number: Cambridge Applied Micros	REV: 1.1
Date: August 15, 1989	Sheet: of	

The MSS20 a universal front-end to your computer based weather receiving system.
by Peter Dobson

Martelec's MSS20 was described by Will Rimell in the spring edition of RIG. The circuit design lends itself for use with many other computers and software packages, not just the BBC computer.

So far I have used this circuit successfully with the Amiga computer in conjunction with ICS's software called Amiga-fax. In fact, the MSS20 bridges the gap left by the ICS package, which allows the reception of shortwave Fax but does not address the problems of receiving APT from satellite.

I have also used the MSS20 with the IBM-PC and a software package called Multifax written in the States by Elmer Schwittek.

I have an Atari to play with and, though I have heard that there are a number of software packages to run on this computer, I do not as yet have access to them so have been unable to ascertain the type of interface used by the Atari to it's data input module. If any one can lend me some Atari software I will determine what changes, if any, need to be made to the MSS20 to interface to this computer and software.

Likewise, for the Apple Mac II, there is some excellent software available through Newcastle Computer Services Ltd. (Dartcom's distributors for their MAC system) but again, I can get my hands on the hardware but as yet not the software. Any helpers?

Back to the adaptations to date.

Using the Amiga with the MSS20.

This is actually the easiest thing to do as the MSS20 circuit as is, right through to and including, the A/D converter interface is directly compatible with the Amiga. Even the 5v supply is easily derived from the Amiga parallel port connector. All that has to be done is to take out the two ribbon cables that were for connection to the BBC. The Amiga does not need the circuits in the MSS20 associated with IC5, IC6, IC7, or IC8. Thus the output via PL2 is not needed either.

PL1 should be connected up via a ribbon cable and connector to a 25 way cannon gold-D socket for the Amiga 1000 or a plug for the Amiga 500 and 2000. The connections from the MSS20 to the 25 way gold-D should then be connected as shown below.

MSS20 PL1	Amiga 1000 Skt	Amiga 500/2000 Plg	Signal Name
1 & 2	23		+5v
3 to 10	14 to 22		0v
11	1		Wr
12	N/C		Busy
13	2		D0
14	3		D1
15	4		D2
16	5		D3
17	6		D4
18	7		D5
19	8		D6
20	9		D7

N/C no connection.

Once the cable has been buzzed through to check for wrong connections the Gold-D end can be plugged into the Amiga. ICS suggest that this is done with the Amiga powered down to prevent possible shorting out of the +5v supply generated by the Amiga. I have only shorted this output once, by accident, and found that all RAM quite naturally became corrupt and I was presented with the Kickstart screen (Amiga 1000) after the Amiga had recovered from my mishap. On that occasion no permanent damage was done.

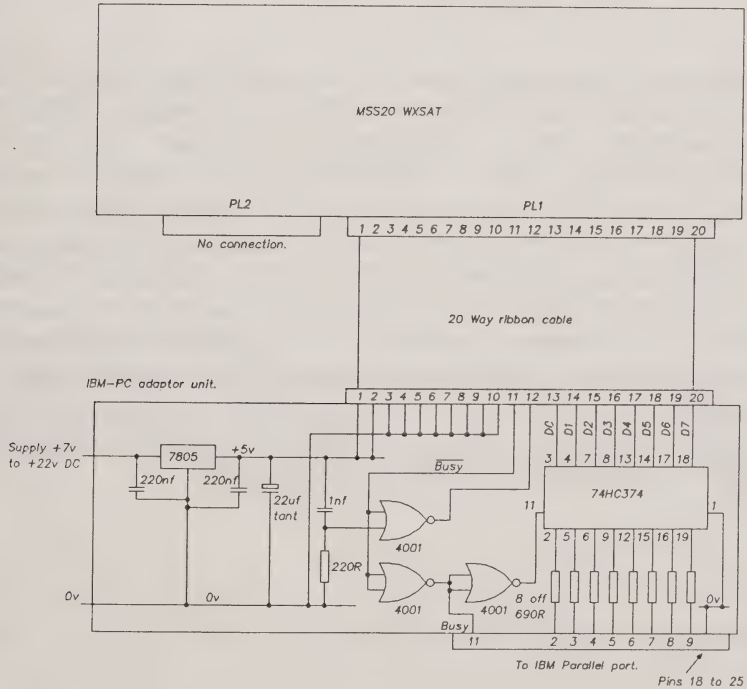
The principle of operation is that the program will ask the A/D converter to convert data by putting the Wr signal from a High to a Low. The A/D converter has its own clock which is running all the time at something like 1MHz so, within 8 microseconds (8 clock beats), the latest conversion is available at the A/D output. The A/D converter conversion speed is fast enough not to warrant any feedback from the Busy line. It could be connected to the Amiga but I do not bother and it runs fine without. The Amiga is thus presented with an 8 bit word giving a possible 256 shades of grey which of course the Amiga and its software cannot use. However, by using all the available A/D outputs, the black and white limit facil-

ities available in the software can be used to the full.

There is another program which runs on the Amiga for receiving APT data currently under development. It is written by Geoff Hatto and makes the greatest use of software for acquiring, demodulating (carried out in software) and filtering the APT signal. Whilst the full 256 shades of grey cannot be displayed on the Amiga, Geoff records all of these shades to disc, Ram or whatever you choose. As a result of this the software has very powerful picture enhancement algorithms, and the ability to zoom the received picture. When zooming it actually displays greater detail on the screen. False colours can be used also. This should be a very powerful package when Geoff releases it. What is more Geoff has achieved all of this whilst running under the Amiga Dos environment.

Using the IBM-PC with MSS20.

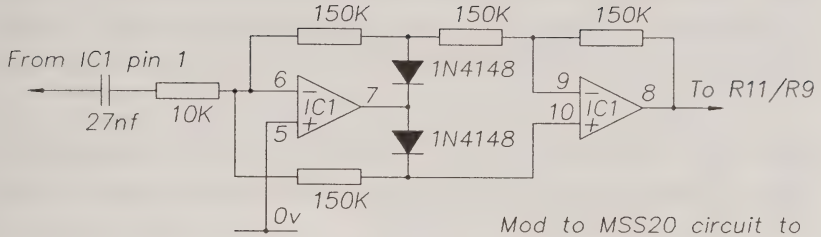
This required a little more work. In the case of the IBM-PC software I am using, the program requires converted A/D data to be thrown at it as fast as possible and continuously. This means that the MSS20 must be made to convert continuously. This has to be done with a little bit of external circuitry as shown below:



I find it a great help to 'scope the input to the A/D converter on pin 14 of IC1 within the MSS20. In this way I can alter the APT input signal from my receiver to get the biggest signal that can be converted, without over-driving the A/D converter. It is also a great help to trigger the oscilloscope off the output from pin 11 of IC8 (ie PL2 pin 19 output). This output is a pulse which occurs once per APT line when the PLL is locked. The point in the line the pulse appears is arbitrary for any given frame but, once running, will stay at that point in the APT line for the rest of the frame, making scope triggering very easy. If you want to look at part of the line on the scope this can be easily done by expanding the timebase by the required amount, and then using the Inc. and Dec. buttons on the front of the MSS20 to walk the visible section of the APT line across the 'scopes screen. A poor man's dual timebase display!!

Because the MSS20 strips off the 2.4 KHz carrier and digitises the filtered envelope, this front end can be used with Meteosat, NOAA or any of the Russian satellites off air with equal success as all the timing is controlled from within the computer and is not related in any way to the 2.4KHz carrier. The disadvantage of this technique is that you cannot recover good pictures from cassette tapes as their speed is not consistent enough. Even good quality reel to reel tape recorders are not good enough.

For those of you who would like more than two thirds of the full wave rectified output from the MSS20 the following modification to the rectifier section of the circuit should put this right. The reason the original circuit suffered this problem is that the two rectifying diodes (D1 & D2) are outside the amplifier feedback loop, resulting in any differences in forward volt drop between the two diodes causing differences to the rectified peaks. As the rectifier input signal is of the order of 2v peak to peak and the forward volt drop of the diodes is approx .5v, production tolerances on the diodes produce a significant difference in the rectified peaks. The modification below takes the diodes within the op. amp feedback loop reducing the voltage differences between the peaks by the open loop gain of the op. amps. (Quite a lot!!)



Mod to MSS20 circuit to linearise the rectifiers Note: All 150K ohm resistors should be 1% tolerence if poss.

In talking to Phil (Ed) about the MSS20 I suggested that this unit was not surprisingly similar to the front end of the YU3 frame store. In actual fact it is identical!!! Rectifier fault and all, so the above mod. to the rectifier applies equally well to the Frame store.

G3ZGJ RIG DISH CONSTRUCTION

by Maurice Wigg

Being not exactly new to the vagaries of horns and dishes, it was a different kettle of fish to be handed a thin aluminium dish by Henry at Sandown, with his special encouragement to find a way of mounting it !

With limited workshop facilities, at least for those of us with little but saws, drills and hammers, it isn't easy, knowing that it must be rigid and stable in all weather conditions!

I decided on what I call the picture frame construction, and for me over the last winter it has proved most successful in every way.

Being a junk yard moocher, I already had some 2" x 2" x 1/8" aluminium angle put by and a square assembly constructed such that the dish rim would comfortable sit on.

The corners were strengthened by 1/8" flat aluminium which is easily bent in a vice.

The fill in at the corner fronts to under the dish rim I again used 1/8" sheet aluminium. Sheets of this often be acquired quite cheaply at Radio Rallies, as few folk find a use for that thickness.
It doesn't really matter if small holes exist in it, for painted, impact glued formica is very weather resistant if a cover up is demanded.

It does entail quite a lot of bolts of the right size to put it all together. Some clever ones might use pop rivets throughout which would no doubt be very satisfactory if done properly.
Four strong hinges are required 'affixed' to the bottom angle to allow dish frame to pivot.

Next a good strong wooden base is required, the width of it exactly matching the dish assembly width. Sound reclaimed 4" x 2" timber ideal, well daubed with wood preservative and painted later. Wood screws or even long nails are required to construct, but whatever sound strength is required.

At either side along its length, five feet in my case suitably packed up between cross members, is fitted a piece of Dexion or other steel pre holed construction angle and the flange flush with the

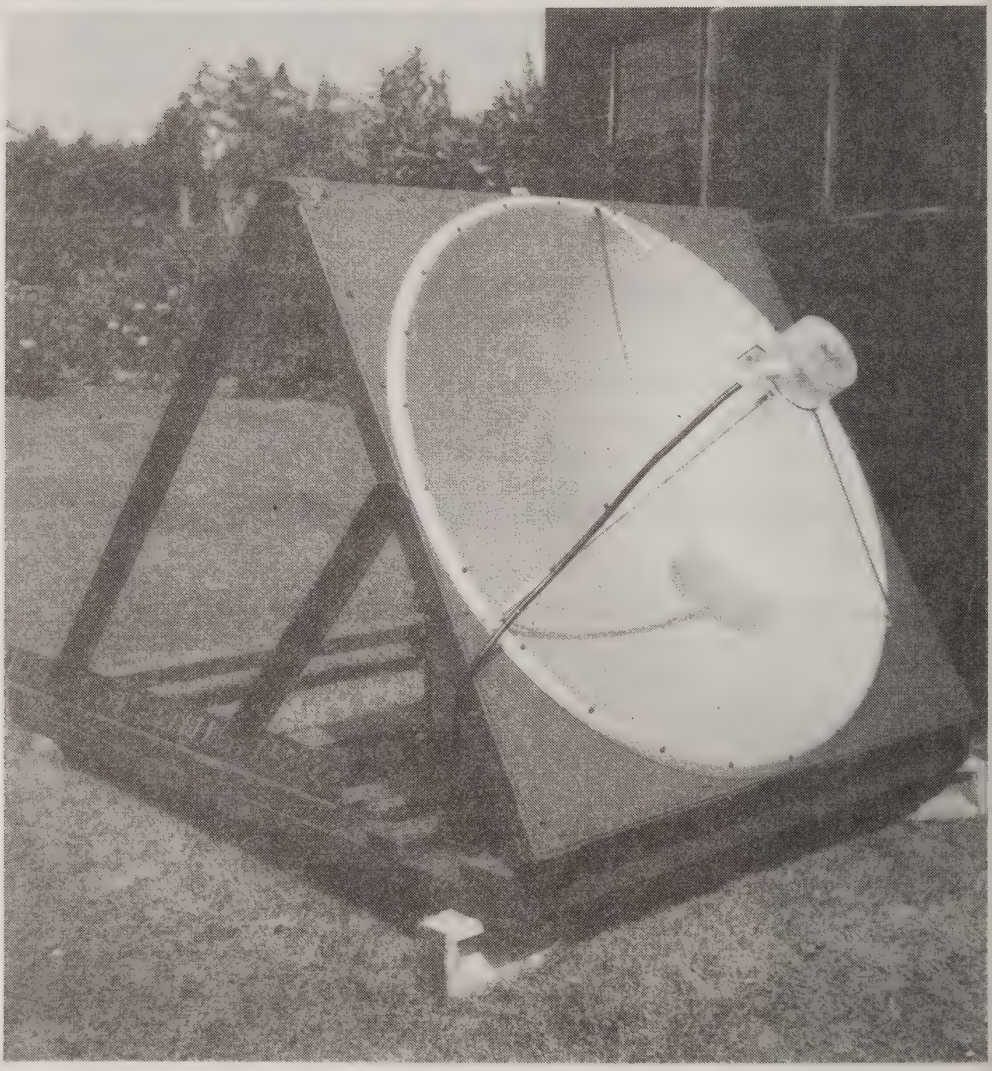
wooden base outer edge.

All that is now needed is four angle iron struts bolted between dish frame and slotted Dexion the lengths cut to give a dish frame to base angle of 57 degrees, allowing for adjustments to be made either way to cope with sloping ground. A single temporary slow motion setting up strut was made but found to be completely unnecessary. Sweeping the dish up and down on its hinges, watching a remote signal strength meter for max signal, proved perfectly adequate.
Likewise rotating the base from the rear down the Greenwich Meridian is not difficult to do.

The fixing and setting up of the horn is included in its own package and needs no comment. I can not speak to highly of the RIG/Dartcom Rx and downconvertor, not to mention the dish and horn feed assembly, for the results are excellent.

The whole assembly provides a relatively wind stable construction, but in exposed situations added weight is easily effected by neatly filling in some back floor spaces with lose concrete blocks or house bricks.

Maurice Wigg dish



RADIO AND METEOROLOGY TALK - 28th October 1989

This meeting will appeal to both amateur and professional meteorologists who have an interest in how radio waves are effected by the weather and will be held in lecture theatre 1, Blackett Laboratory (Physics Dept.) Imperial college, Prince Consort Rd, London SW7.

Parking is not often available within the college premises but south Kensington and Gloucester road underground stations are near by and buses stop at Royal Albert Hall, Kensington Road.

Coffee and tea will be provided on level 2 of the Blackett Laboratories; lunch is not provided but facilities are available within 10 minutes walk in Gloucester Road and South Kensington.

You are requested not to bring food or drink into the Lecture Theatre. If you bring your own refreshments there is only limited space available to sit and eat.

PROGRAMME

0930	Arrival and Registration
1000	CHAIRMANS INTRODUCTION
1015	METEOROLOGICAL INFORMATION BY RADIO AN OVER VIEW OF WHAT IS AVAILABLE Martin Stubbs (Meteorological Office)
1045	RADIO SONDE: HOW IT WORKS AND WHAT IT MEASURES Richard Pettifer (Vaisala UK)
1115	SATELLITE PICTURE RECEPTION AT HOME Henry Neale, G3REH (Remote Imaging Group)
1215	THUNDERSTORM LOCATION BY RADIO Tony Lee (Meteorological Office)
1245	LUNCH
1415	THE CHILBOLTON RADAR John Goddard (Rutherford Appleton Laboratory)
1445	METEOROLOGICAL ASPECTS OF TELEVISION INTERFERENCE Ray Flavell G3LPT (RSGB Propagation Committee)
1515	TEA
1545	WEATHER IN THE IONOSPHERE ? Jim Bacon, G3YLA (Anglia Television)
1615	OBSERVING AURORAS Charlie Newton G2FKZ (RSGB Propagation committee)
1645	Panel question and answer session
1715	CLOSE

RECENT IMPROVEMENTS TO THE EHRLER LNA
by John Dubois

The LNA design by Ehrler presented in issue 89-1 JESAUG and reprinted in RIG 17 has been duplicated and measured by numerous individuals since publication early in 1989. In general it has proven easy to build and get into operation. Careful measurements on the Hewlett Packard 8970A noise figure meter by two independent laboratories, however, has shown the original claims for noise figure to be optimistic if applied to a random unit which has not been optimised. The various unoptimised units have been measured on the 8970A from 6 db to over 1 db noise figure.

Gain is much less variable, coming out between 36 and 38 db.
The good news is that improvements have been worked out which will insure that a newly built amplifier will come out between about 0.7 and 0.9 db noise figure. The circuit changes can be easily made even if the LNA has already been built.

In addition to improving noise figure, these changes will also make the amplifier unconditionally stable. Most of the variability in noise figure comes from less than optimum biasing of the first stage Gasfet U1.. The changes below will improve the chance of coming out at a suitable bias without adjustment, but the bias point also be optimised if you have access to a method of evaluating noise performance of the amplifier.

Make the changes below or build using the new parts.
The component designations refer to the figures in the original article.

Part placement will be identical to the original.

PART	OLD VALUE	NEW VALUE
L4	.33 uh moulded choke	2 turns # 28 enamel at .1 diameter, close wound
L3	4 turns # 28 enamel .055" dia. on 1K	50 ohms 1/8 watt carbon comp. with 3 turns wound on lead on one end. Wind these coaxial with the same diameter as the resistor

		body. Space about one wire diameter.
L6	4 turns # 28 enamel .055"dia. on 1K	50 ohms 1/8 watt carbon comp.

If you have any way to observe noise performance, such as a noise figure meter or looking at the signal to noise ratio of a weak signal on a spectrum anayliser, then the U1 biasing can be optimised.
Optimum noise figure will be near 10 milliamperes, or less, through RI and around 2.5 volts from drain to source. The best procedure will be to first vary the drain to source voltage by substituting a small pot for R2. There should be a noise minimum between 10 and 150 ohms for the value of R2. If the noise minimum occurs close to the upper value of 150 ohms, then the Ui current should be increased by lowering R1 about 20% and repeating the adjustment of R2 for noise minimum.
Continue this procedure until the adjustment of R2 shows a clear minimum between 10 and 150 ohms.
Even without bias optimisation, the parts change above will usually bring the amplifier well under 1 db noise figure. Even better noise performance, measured as a true .5 db on the HP8970A, has been obtained by using the new NEC320 series HEMT transistor (about $28) in place of U1. In order to use this transistor, however, several other changes are necessary to restore stable operation.
The changes will not require surgery on the board pc foil and can be easily retrofitted. They will be published, after careful testing, in the next issue of JESAUG and subsequently RIG.

An attempt to receive and display NOAA high resolution pictures

An ongoing saga by Peter Hayes, GM3RAO

In the beginning

After my enjoyable years operating Amateur Radio on the HF bands, I got the notion to investigation the reception of weather satellites. As we all know, once you start this hobby, nothing else matters and so it was with me. I put together bits and pieces to receive NOAA and Meteor satellites, and constructed a home view frame store. I can now receive the Polar Orbiters and Meteosat, displaying the pictures on the frame store, and pan and zoom around the picture to pick out interesting details.

Here I reached an impasse. There was not a lot I could do to improve the system further. I could add colour but I don't like false colour images.
I could buy an expensive computer and animate images, but an Archimedes is over £1000 and my wife wouldn't let me get away with it anyway. So progress had to come from else where. I kept hearing about HRPT, improved resolution (1.1 Km instead of 4 Km); 5 imaging channels at every pass, not the two the satellite chooses to send on its APT channel. Signals already in digital form so not picture impairment from noise, interference pagers etc.
All these fascinating possibilities without knowing how to actually do anything about it.
A phone call to Henry Neale produced the information that Wireless World had published an article on this subject in 1981.
Bob Sansoni confirmed this (and also said that it was not';t easy) and I eventually found the articles in Glasgow's Mitchell Library, (WW Nov 1981 to Jan 1982). So there I was, armed with a few photocopied pages from WW and rarin' to go.

Around the same time I obtained a copy of the write up of the Dundee University Hi resolution Meteosat reception system and it was apparent that Meteosat, whistle being easier to receive (point a bigger antenna at the satellite, no tracking, etc) was a lot harder to deal with without clever computer programming (Bob told me that too).
Computer programming is not my scene anyway. So current plans to receive Meteosat Hi resolution digital data were put on ice, but the manual is worth a read even if only to get general overview, and there are many similarities with HRPT. For example with a

change in receiver bandwidth the same demodulator could be used for both Meteosat and NOAA.

First step. See if the signal was there, and get some idea of what it was like, the feel of it if you like. At least, picking up the signal is a great psychological boost even if all you here is a whistle from the speaker. Some calculations suggested that if I tuned the Meteosat converter to 1691 MHz (Met-4 channel A), NOAA 10 on 1698 MHz would come out of the converter on a 144.5 MHz. (1698-1691=7. 137.5 (converter output frequency) +7 = 144.5). Bingo.
This is in the 2 meter amateur radio band, and like most radio hams I have a 2 meter rig, the ubiquitous FT290,listen on SSB (more sensitive) and wait for NOAA 10. I started tuning round for it, waving the quad loop yagi in the general direction of where NOAA 10 was supposed to be. I eventually found it some 50 KHz or so up the band and the Doppler on it took me totally by surprise. I expected some but this was about 75KHz on an overhead pass (NOAA'S 137.5 MHZ Doppler is about 7KHz at its greatest). Loads of polarisation twist, RHC is a must, but also loads of signal, knocking the S meter on the 290 hard over, and the experiment was a resounding success. Just a whistle of course, no " clip-clop" like the APT signal, but I was really encouraged to set off on the long road to receiving HRPT images.

So the reception and display of NOAA HRPT images became the goal.The raw data is generated by an "Advanced Very High Resolution Radiometer" or AVHRR for short. This views the earth below in two visible light wavelengths and three IR wavelengths. Samples of two sensors are processed and sent as the APT signal we all know and love. The five originals are digitised and sent on S band. 1698 MHz for NOAA 10 and 1707 MHz for NOAA 11, Right hand Circular with a transmitter power of 5 Watts. The data comes to us at 665.4 K bits per second and with the modulation system employed has a transmitted signal bandwidth of about 5.7 MHz. The signal is sent in what is known as "spilt phase low" (s*-1) format, and phase modulates the transmitter carrier. This s*-1 seemed to me at first to be unnecessary complication but on studying it further the benefits are considerable, for example the system clock needed for the digital processing is inherent in the signal and is easy to extract.

The WW articles describes the S band front end. The receiver with its phase demodulator, and digital circuits to process the s*-1 into 10 bit parallel data suitable for computer or frame store manipulation. Also included in the article is a" satellite simulator". This gener-

ates a 10.7 MHz carrier, phase modulated with a choice of signals, including a sync pulse identical with the one sent by the satellite. These signals are also available at baseband, so you can compare the processed versions with the originals and check the system out all the way from the IF onwards with out the need for a "live" satellite signal, very useful since the satellite is available for only a few minutes at a time. Building this seemed the natural first step, and apart from the digital clock xtal, all the parts came out of the junk box. It worked first time, and is an essential tool if you're attempting HRPT reception.

The next flurry of activity was to build the s*-1 decoder and bit conditioner. Doubtless everyone has his own way of working, but I've found a nearly fool proof way of putting digital circuits together accurately is to photocopy the circuit and then ink over every line on the photocopy as it is wired in. Omissions and errors come to light very easily, so the main hazards are dry joints, solder brides and omitted power supply lines (these are rarely shown on circuits to save the clutter so I tend to forget them!). After sorting these out it seemed to work although I have a few problems to iron out, but it would be boring if every thing worked first time! Also along the way comes ideas to improve / simplify the circuit, but I am going to press on and get pictures before branching out !

Since the only signal I had available was from the simulator, I decided not to construct the Serial to Parallel converter just yet. It seems to be a simple circuit, not much to it, easily put together in an evening and besides there are no tweaks to play with ! Also, one of the problems with the decoder board is getting the two clock phase 90 degrees apart. So I decided to tackle the phase demodulator and hopefully some inspiration will come before to long and the clocks will sort themselves out. It's called sweeping the problem under the carpet ! just as well I'm not being paid for the R&D or my jotters would be in the mail.

How I get on with the phase demodulator you will have to wait for next time.
So far I have got the simulator working, I know the satellite is there and the digital side of things is coming along, if not nicely, then at least with the prospect of getting it going soon. By next time I hope to have signals of some sort from the satellite to work with.

NOAA PREDICTIONS ON THE PSION ORGANISER
by Peter Hayes

The Psion Organiser is a compact pocket computer containing a wide range of facilities. Besides being an electronic note book it is a powerful calculator and computer with a useful subset of basic known as" Organiser Programming Language". OPL

Programs can be held in RAM or can be permanently stored in plug in Eprom memory modules known as data packs. At switch on the computer displays a "high level" menu of options, "Calculator", "Diary", etc and it is easy to write a NOAA prediction program and install it in this high level menu for virtually instantaneously use.

Type in the programs exactly as shown. Note, unlike most basic, OPL does not use line numbers, so each line is terminated with the "EXE" key. The orbital parameters for NOAA's 10 and 11 were taken from Rig 15 and are a little out of date, but the net effect on calculations over 24 hours is negligible. The latest Rig or weather watch Figures can be substituted if you like. Test the program with data from Rig predictions, times and degrees should come out within 1 degree and 1 minute or so over a 24 hour period, and will not be far out over three months. This is probably all the accuracy you need. Users needing greater accuracy would refer to other sources anyway. In practice I enter the nearest times given in the Rig and in the "-"or "+" keys will allow me to spot orbits of interest earlier or later respectively. The "Q" key returns you to the high level menu. When you are satisfied with the program, save it to Datapack and install it in the high level menu. I named it "NOAA" (naturally).

In use, it takes less than 20 seconds to check out a days orbits, far faster than firing up, say, a BEEB, loading a disc and thumbing through menus. No doubt the really cleaver programmers could make the organiser sound its alarm when the next pass is due !

PS The programs were printed directly from organiser using comms link so they should be 100% accurate, printer errors excepted

```
NNOAA1:
REM    OD AND OI EX RIG-15
GLOBAL EQT. Z. H. M. S. D. OD. OT. O. OI.
PRINT NOAA 10 OR 11 " ;
INPUT Z
IF Z=11
OD=102.135
OI=25.5333
ELSE
OD=101.2761
OI=25.3192
ENDIF
CLS
PRINT"ENTER EQT"
PRINT"H:";
INPUT H
PRINT"M:";
INPUT M
CLS
PRINT"EQT = ";H;":";M;2:00"
EQT=(H*3600)+(M*60)+S
CLS
PRINT"DEG WEST"
INPUT D
CLS
OD=OD*60
PRINT"REF ORBIT:"
PRINT H;":";M;":";S;"   ";D
LOOP2::
CLS
PRINT H;":";M;":";S;"   ";INT(D)
PRINT "+ - OR QUIT (Q)"
Z=GET
IF Z=81
STOP
ELSE
LOOP1:
GOTO LOOP2::
ENDIF
```

```
LOOP1:
IF Z=88
EQT=EQT+OD
D=D+OI
IF D>359.9999999
D=D-360
ENDIF
ELSE EQT=EQT-OD
D=D-OI
IF EQT <0
EQT=EQT+86400
ENDIF
IF D<0
D=D+360
ENDIF
ENDIF
HMS:

HMS:
LOCAL A
A=EQT
H=INT(A/3600)
A=A-(H*3600)
M=INT(A/60)
A=A-(M*60)
S=INT(A)
IF H>23
H=H-24
EQT=EQT-86400
ENDIF
```

Information for Satellite Tracking
by Des Watson

Those of you who are fortunate enough to have a computer connection to USENET have access to a regular supply of orbital elements from the NASA Predications Bulletins.

USENET is a huge, worldwide bulletin board system which logically link thousands of computers. It enables users of these computers to post and receive articles covering a very wide range of topics. USENET makes use of existing hardware and software communication links between computers such as the JANET network in the UK (linking most academic sites and some commercial and government organisations). Articles are grouped into "newsgroups", each devoted to a particular topic.

One of the newsgroups (sci. space) currently receives about 20 messages per day. Each week, the most current elements from the NASA Prediction Bulletins are posted to this newsgroup. Each posting contains the two line Kepler parameters for about 100 satellites, normally including all the currently active weather satellites. As well as being a regular, accurate and comprehensive source of data, this facility offers the additional advantages of allowing predication programs to read this data directly, removing the need for retyping.

So if you have access to USENET have a look in the sci. space newsgroup-you might find much information of interest.

A related issue is the actual writing of prediction software.
Sometime ago, I wrote a prediction package and because I wanted to write something which produced fairly accurate answers, I decided to do some research. I consulted various books on celestial mechanics and a couple of NORAD technical reports and finally wrote some code which seemed to work (but it still doesn't have a decent user interface!). In my research, I also came across an excellent book called "Astronomy with your Personal Computer" by Peter Duffet Smith (CUP, 1958). Although most of the algorithms described are of limited relevance to satellite tracking applications, I found it to be most interesting and helpful, and I would recommend it to anyone with even the slightest interest in the wide field of Astronomical predication.

AMIGA CORNER
by James Brown

Its been fascinating to see how the numbers of AMIGA owners in RIG has increased over the last year or so. My offer of demo disks brought about 30 requests rolling in, some as far afield as Norway - (Greetings to Leif Enebrand in Sweden!).

The ICS unit (reviewed in RIG issue 16, March 1989) has proved popular, and despite the niggles is capable of some first-class results if you feed it with the right signals. However, there have been some complaints of problems, which seem to centre around the introduction of what are know as 1.3 Amigas. These are the same as the ordinary A500 or B2000, but have a slightly modified operating system (Kickstart), which is contained in a large 64 pin EPROM. AMIGA 1000 owners don't have to worry because their operating system is loaded from disk, and they can decide which one they want as the machine boots up. Apparently, after a certain number of lines have been read in, machines will just hang up and refuse to continue. This kind of problem is usually caused by software writers using 'illegal' short-cuts to get their special effects, and so its not really the machine to blame but the writers of the programmes. In this case it looks as if a small piece of extra code in Kickstart is blocking the route that he ICS software wants to follow, and hence the machine freezes.

At the moment the only way out may be to change the O/S for a 1.2 version, but prospective buyers would be well advised to check with ICS as to what the situation is before buying a unit. They have recently changed address, so I've given their new one at the bottom of this article.

One other small niggle has been encountered by one of our RIG members with an AMIGA A500, and that was an internal clock that was somehow set to a slightly different rate so that a satellite pictures were displayed skewed across the screen. Whether this may have been an imported machine or a wrong crystal setting is yet to be confirmed, but if you meet this fault let us know.

I'm sorry to have to warn you that Terry Cassell's item on receiving satellite pictures from Teletext via the Microtext adapter is now incorrect. Sadly, the good old BBC with their blinkered eyes ever

set on the sights dictated by hatchet accountants and audience figures, have just dismantled the entire Teletext software service at a few weeks notice. Just when they had added to the data-base IBM s/ware and the satellite picture service! Its a bit like the gas-board coming to dig up the road just after its been re-tarmaced! There seems no likelihood of it resuming so whilst the teletext adapter would still function as a teletext receiver, the download facility seem now to be redundant!

A couple of new interfaces seem to be on their way for the AMIGA, the sharp-eyed among you may have noticed the advertisement by Timestep in the last RIG issue (17) and hopefully we may have details and even a possible review by the next issue. ICS aren't letting the grass grow under their feet either though and I've just received details of a package from the States that they'll be marketing called AVT (Amiga Video Transceiver). The initial documentation looks excellent with all sorts of goodies like user defined demodulation curves, and unattended operation. Its still a basically FAX/SSTV set-up but with a fair bit that the satellite community could use. So watch this space for more details.

Lastly, the 'Henry' loop yagi is now in permanent position picking up the relay from GOES 5 which is currently giving superb noise-free pictures from all around the world. Nice one 'Enry! I hope at some point to do a demo disk on the life cycle of a hurricane using some of these stored images. Don't write in yet though! Its also been good to have a chat with quite a few of you on the 'phone, so keep the comments rolling in, and let us know of any developments you come across for the benefit of other Amiga owners.

Cheers,

James Brown

ICS Electronic Ltd
Unit V, Rudford Industrial Estate,
Ford,
ARUNDEL,
West Sussex
BN18 0BD

MEMBERS ADS:

FOR SALE:

1. Remote Imaging Group V.H,F. scanning receiver. Fully built, working and mounted on a single "euro-card" Front panels controls include:

LED display of channel selection 1 to 99
Scan, Hold on busy and halt selection
Signal strength indicator
Low noise amplifier/pre-amp power on/off
Volume
Squelch
Power on/off
V.H.F./U.H.F. selection (by the way of an internal relay for selecting input from the two coaxial connectors on the rear panel)

2. LMW electronics Meteosat down-converter. Fully built and working down-converter mounted on a single "euro-card". Front panel controls include:-

Power on/off
Channel 1 / Channel 2 selection (both Xtals fitted)

3. The YU3UMV Frame store fully built and working original frame store mounted on a single "euro-card". Complete with the following modifications:-

Audio input filter mod ref RIG 2 Don Mclean page 13
2 picture conversion ref RIG 3 Bob G6KMM page 6
Auto rest for Meteosat ref RIG 3 Bob G6KMM page 6
256 K Ram fitted (6)
Analog To digital conversion indicator pcb fitted ref RIG 8 page 38
Blanking pulse removal ref RIG9 Roger G4IDE page 24
Front panel controls include:-

Page 1/2 selection (although 4 are available)
Halt / Scroll
Meteosat / NOAA line frame format selection

NOAA ascending / descending
Picture skew east / west
Zoom times 1 or times 2
Power on / off
LED Indicators for:-
Power on
Peak white
Peak black

4. Audio input / output routing PCB constructed on a single "euro card" for the use of connecting external inputs (2.4 KHz oscillator, tape recorded passes etc) and outputs to other equipment.

5.Power supply. Commercial power supply fully regulated and current protected.

6. All the above items are housed in a standard 19" metal Euro Rack.

All the above items are offered for sale as a complete system for £480.00 of less the Rig scanning receiver for £340.00.

This includes a donation to Rig.

Bob Sansoni G4MWR
Tel. 0904 425619.

FOR SALE:

Cambridge Z88 Laptop computer with 3 memory packs, mains psu and soft case. IBM and BBC interface leads & software.

£160

Call Stan Ames, Harpenden (0582) 760538

FOR SALE:

Muirhead Facsimile K600D, 2 units, one converted to Wefax, one almost complete for spares, full documentation.

£25 with two rolls of paper, Carriage extra or collect.

Contact: E. Chicken, G3BIK, 21 Townsend Crescent, Kirkhill, Morpeth, Northumberland, NE61 2XP.
Tel 0670 513994

FOR SALE:

YU3UMV Frame store with 256k memory £90 ono

RS 12" Black & White Monitor £90 ono

Angus McGugan, GM4JTZ
29 Langmuir Avenue
Kirkintilloch
Glasgow
G66 2JQ

Tel 041 776 6266

ERRATA

RIG 17 Page 19:
The model type of the Sanyo tape recorder is the RD220 and not the RD22 as printed.

MEMBERS LETTERS:

SOURCES OF INFORMATION from Lawrence Harris

Sources of information on some aspects of satellite matters can be difficult to find. I have found some but still search for others. We often see references to announcements made by TASS or NASA etc and I had wondered in what form these announcements are made.

Many years ago I got on to the Novosti Press Agency and arranged to receive their Space Bulletins. They are usually rather dated often several weeks old but can be of interest. Unless you are really keen to receive this information I would not apply for it.

A more intriguing source came to life while perusing Short Wave Magazine-that of rtty (radio teletype) broadcasts. I lashed out on a ERA Microreader and have since been able to monitor TASS broadcasts. I must confess that I have sat through a lot of interesting though irrelevant data but I am determined to locate a transmission on satellite material

The frequencies used to change from season to season but I would presume but that this source would be the most up to date? An interchange of information would be useful here.

For those with short wave receivers the frequencies so far indenified for TASS data are 14.49, 14.51 and 18.38 MHz.

The aerial used is a long wire and the transmissions are 50 baud and 425 Hz shift. Perhaps someone has all this information secretly logged ?? Please let us all know about it. I shall spend more hours until I have it cracked and then I shall write to RIG about it-unless someone writes first!

From time to time there are comments in RIG such as 'Chinese statements about Feng Yun 1....' It is this type of broadcast that is potentiality so interesting to me.

How nice it would be for RIG to be able to establish a phone link to provide 'hot' data on launches etc.

I have also collected data on certain COSMOS transmissions

around the 20 MHz band eg Cosmos 1984 on 19.989 MHz etc.

Where does one find more data about possible reception of such signals ? I have never (knowingly) heard such signals but would love to find out more. Any offers ? You can leave a weather satellite receiver scanning for new WX sats but not at these frequencies!

Lawrence continues in a following letter:

How dramatically things can change over a period of just a few weeks! Just after RIG published my letter about satellites and the Media I had a phone call from the New scientist and a letter from Spaceflight magazine.

The NS wanted to send a reporter and a photographer down from London to discuss my satellite activities. I must admit to having had feelings of both puzzlement (there are many experts near London so why come to Plymouth) and pleasure (yes , the thought of being mentioned in the NS was terrific).

The article duly appeared, and in a more accurate form than I am used to seeing. As mentioned in my previous letter reporters often get things wrong, leading occasionally to, shall we say unpleasantness from unexpected quarters. The NS reporter Helen Gavagham was very competent.

A week or two later I was in touch with Henry G3REH and was very happy to see his kind comments in the following RIG. The NS has been referred to me by a third party.

Coinciding with all this activity came a request from Spaceflight magazine for 1500 words on my Okean activities.
I had originally written a letter to them in January about the regular transmissions from Okean and my processing of its data by computer. Subsequently the article was published in the June edition.
A similar letter sent late December to Spaceflight had been ignored.

Meanwhile I had been sending a regular reports to Short Wave Magazine on my weather satellite loggings for well over a year. Most of the data has been published and I had occasional chats with
Pat Gowen who wrote the column ?
Then the next bomb shell! Would I write the column !

So as some RIG members will be aware I now write the info in Orbit column in SWM.

It is an exciting opportunity to introduce the subject to a casual but wider audience and my post bag shows the great interest that radio enthusiasts have for the topic.

I need hardly add that RIG provides an unrivalled expertise in this area which is why I refer to it in the articles.
May I point out that if anyone would care to write to me about their station and activities I would be delighted to hear from them.
Photographs will be returned so no sae is necessary.

Lawrence Harris

5 Burnham Park Road
Peverell
PLYMOUTH
PL3 5QB

Dear Phil,

I am sending this sos in the hope that some of your more erudite readers may hear this call for help and come to my rescue. I have been using my frame store for about a year now and getting good pictures, but no matter how I try, my LOK Sync board continues to baffle me. The 2400 Hz crystal oscillator and the line shift circuits which are housed on this board both work fine, but no way can I get the push button sync on IR or Visual images to do anything at all, so I have to wait for a few lines of picture to appear to find out whether to shift to the right or left. Murphy's Law dictates that I always make the wrong decision anyway, so most of my pictures of North America appear in the form of a dramatic looking staircase across the screen, and all this has to be suffered before I can settle down to enjoy those pictures of heavy cloud over the U.K.

I have tried all the usual tricks as suggested by Les Currington (RIG 15) plus some others which Grant Dixon found effective, and even built Grant's LOK Sync tester (RIG 13) but all to no avail. Needless to say, all components have been changed ad nauseam, and the pots have been replaced by ten turn units which provide much greater precision in setting up on frequency. Are there really lucky people who can produce a visual or IR image just at the push of a button ? What luxury! I offer a small prize the first reader who can tell me where I am going wrong. Better yet, a small fee awaits anyone who can build me a working LOK Sync board, but please phone first (0843 601845) lest the postman should come bearing sacks full of working LOK Sync boards. I should be so lucky, as we use to say in the trade.

Your's Sincerely

Ken Willis

SUGGESTED SERIES OF ARTICLES FOR NEW MEMBERS

I believe a series of articles along the following lines would prove to be of benefit to many new members. Given time, it could also result in additional applications being received for membership of RIG. If the above articles are to be considered, perhaps this could best be attempted under three main headings as follows;

(A) : Launch profiles

(To include the following information)
Revolution times - Track separation - Orbital inclination (various) and not just the craft in Polar orbits

(B) : Radio Tracking

(To include the following information)
Receiver requirements - Possible Aerial Arrangement - Interception of Beacon Signals (not APT) - Radio Frequencies and Tuning Techniques

(C) : Automatic Picture Transmission

(APT) (to include)
Equipment Requirements - Aerial Arrangements - Techniques employed Re. Operation of all equipment - Reception of all Equipment - Reception of APT From Geo-stationary Satellites and those in close Earth Orbit (NOAA -10/11 and others)

A devised " question and answer service" to support the above articles would be of help, and would assist learning considerably.
If new members could be put in touch with each other, this could perhaps also go some way in assisting a better understanding of the subject as a whole.

Interception of Beacon signals from satellites at various orbital inclinations and "not" with APT capability, has been included at (B). I believe that this single aspect alone will be important for the beginner for two reasons; It will provide him with good training and encouragement and secondly, raise interest and enthusiasm towards eventual reception of Automatic Picture Transmissions.

If the above details were to be published in issues of the Newsletter under the three headings as suggested, clearly it could not all be adequately covered in just three issues. Under these circumstances, would it not be possible to have the above information typed and duplicated and offered for "sale" to all new members, or any other member that may be interested? I would be happy and willing to assist with some of this typing if you think it may help in any way.

Sam F Smith

Dear Phil,

Last year I bought a book called "Communications Satellites" by Larry Van Horn. It is a gold mine of information, photographs and diagrams on manned spacecraft, scientific, weather, navigation, communication and surveillance satellites. It has a comprehensive list of all known past and present satellite frequencies from 1.5 MHz to 563.3 GHz, including deep space probes, data collection uplinks, telecommand channels, and also has tracking station networks. Scanner enthusiasts will have a field day!

This book is from the USA where the authorities are less paranoid about what the individual may tune into. It has a 14 page section on amateur radio satellites, a 4 page list of general further reading, and covers Molniya tracking and reception.

There is not much point in expecting to pick one up at a radio rally, as I've been going to them for 8 years and have never seen it for sale. It is available in the UK for £13.25 + £1.25 p&p from;

Interproducts Ltd,
8 Abbot Street
Perth
PH2 0EB

The book number is 0-944543-01-4.

I have no connection with Interproducts Ltd

Happy Reading,

Graham Smith G1JVZ

Dear Phil,

Well the Framestore's up and running at last and all went fairly smoothly, apart from a couple of duff IC's and one or to dry joints. I have fitted 256 kb memory, 4 pictures, RF modulator etc and the results are very good, even being able (with care) to line up NOAA images.

It is my intention as a future project to add colour, and also to look into the possibility of a direct printer interface that does not rely on a computer.

Whilst building and testing the store it became increasingly obvious that all the information on the framestore is very fragmented, bits here there and everywhere and details for setting up, testing and fault finding are very scarce or none existent.

Now having made a criticism I am prepared to suggest a cure and help towards this end.

My suggestion is a special edition of RIG Newsletter or more preferable a separate booklet dealing with the framestore alone. If you think this is a good idea I am prepared to act as coordinator for all the information required for this and if you want to put my name, address etc in the Newsletter suggesting that members could send details of any mods, cures, faults etc however trivial (one persons simple cure may be somebody elses headache!) and they could be included in the special edition booklet with chapters on building, testing, fault finding etc.

Phew! sorry for the long rambling letter but its a subject that has been on my mind for some time now.

Now to my own needs, I believe issue 4,5,6,7 of the Newsletter are not available now so could some kind soul somewhere lend me these for a short time. Postage will be refunded by me.

Will keep you informed of any progress on future projects.

Tony Knight, G4RTT, Isle of Wight

RIG HELPLINES:

General Enquiries & PCB Supplies
Phil Seaford 0525 384419 7.30pm - 9.0pm

NOAA information Henry Neale 094 585 353

Russian, Chinese satellite info/status
Les Currington 0707 326058

Schools/ Educational enquiries,
Meteosat status and European Space Agency — Colin Hall — School 021 778 1311, Home 021 449 0006

Framestore technical support — Mike Coombs 0530 243494 7.30pm - 9.30pm

Ian Gurton 05827 3770 7.30pm - 9.30pm

Dermot Dobson Correspondence preferred

RIG Dish & Feed Horn Stockists — see back of previous newsletters

Supplier problems co-ordinator Stan Ames 05827 60538

RIG at Rallies 1990 Mike Coombs see above for No.

MICRO SPECIALISTS:

BBC Micro Stan Ames see above

Commodore Amiga James Brown 0656 712632

Atari ST, Archimedes Peter Newman 0487 812121

IBM PC Dermot Dobson see above

Please call at sensible hours ie 7.30pm - 9.30pm

1.6 GHz Low Noise Amplifier - Hard to get parts form RIG:

LNA PARTS KIT.

As a follow up to the short paragraph on the low noise preamp kits in the last newsletter, the Remote Imaging Group is now able to offer the essential parts for you to build this preamp.

The kit of parts will be as follows:-
2... NEC 72084 GaAs Fet's
1... MAR-6 MMIC
2... 5.6pF High-Q chip capacitors
7... 100pF chip capacitors
1... N type plug to fit UT141 coax
1... Plated thru hole PCB

also included are the small carbon composition resistors and a short length of 0.141" semi-rigid coax.

The remainder of the components are readily available and have been omitted to keep the price down.

The components are high quality and have been tested by the manufacturers before dispatch,the GaAs Fets are easily damaged either by static or excessive heat when soldering so take great care when handling them.

By the time you read this article the components will have been ordered but may well take up to 6 weeks to arrive, so please be patient.

The cost of these kits will be £30 which includes post and packing.

To order a kit send a cheque,made payable to "The Remote Imaging Group",
to the Hon Sec at 14 Nevis Close,
Leighton Buzzard, Beds, LU7 7XD.

One final point that I should make is that the construction of this pre-amp should only be attempted by those of you who have had previous experience.
The remote imaging group is unable, at this time, to provide a building service.

I.Gurton.

The Late P.W. Hand, G4IGA

I am writing on behalf of the widow of Mr. P W Hand, G4IGA, to inform you that he died of a heart attack on 8th June 1989, at the age 67.

Phil had been a keen electronice enthusiast from his RAF days and had also been a contributor to magazines such as Practical Wireless.
His interests in amateur radio covered the entire spectrum from HF rag-chewing to satellites, data and remote imaging.

K H J Rainbow, G0KXR

Editors note:

I have also been advised of the death of Harry Jaye, G6ZEV, who lived in Eversholt near Milton Keynes.

Images prefixed with a L are relays from the American GOES series of satellites via the Lannion Earth Station in France

LY	North America - Infra-red - 8 Km resolution
LR	South America - Infra-red - 8 Km resolution
LZ	East coast of North America - Visible light - 1 Km resolution.

The X series of images relayed from Lannion are digital transmissions of high resolution data and can not be received by conventional WEFAX equipment. Indeed the modulation is such that it cannot be readily resolved or heard using such WEFAX demodulation techniques.

LX	North America - a combination of a 2500x2500 pixel visible image and 1250x1250 Infra - red image giving 2km and 7km resolution respectively.
LXI	Infra - red only version of LX
LXIV	Infra-red/Visible combination of LX?

The A & B series of images from Meteosat, like the LX series relayed from GOES, are digital transmissions. The A series are whole Earth disc images and the B series are of Europe, N. Africa and the Middle East. The apparent gaps in the schedule are to cater for the longer transmission times of these digital images. Different digital images also take different times depending on the pixel dimensions.

The coding of the letters following the A or B are:

I for infra-red, W for water vapour and V for visible light.

AI	AIV	AIVH	AIVW
AW	BIV	BIVH	BIVW
AV	BIW		

weather satellite systems and kits

MSD20 METEOSAT DISH ASSEMBLY

A high quality, precision made aluminium dish and mount assembly, complete with dipole feed. The universal mount design enables it to be either wall or patio mounted. Used in conjunction with our MSC20 ultra low noise downconverter it is capable of superb results otherwise only achieved with larger dishes. Diameter 1m (requires no planning permission).

Complete with mount & feed assy.	£139.73
Next-day delivery & insurance	£18.00

MSC20 ULTRA LOW NOISE DOWNCONVERTER

The ultimate in low noise downconverters ford the best possible, noise-free pictures. The MSC20 uses the latest GaSFET technology to achieve its incredibly low noise figure. The MSC20 is complete with temperature controlled Meteosat ch1 & ch2, and housed in a weatherproof ABS enclosure for masthead mounting.

	£159.45
Optional regulated 12v PSU	£13.80

METEOSAT DIPOLE FEED ASSEMBLY

A high-quality, silver plated dipole feed assembly for the best possible performance from your dish. The feed has been custom designed for Meteosat reception, and is machined from brass before being completely silver plated.

The feed has a 50 ohm impedance, and is terminated by an N-type socket. Mounting is by means of four M3 fixings on the connector flange.

	£42.95
Carriage & Insurance	£4.00

MSR30 - NEW HIGH-SELECTIVITY RECEIVER

Watch this space for an announcement soon on a range of new, synthesised receivers. These new receivers are feature-packed, state-of-the-art designs, making interference problems a thing of the past.
More details upon request.

MSA20 CROSSED-DIPOLE AERIAL

A high-quality, well finished aerial designed specifically for weather satellite use. Comes complete with ground-plane radials, and now with pre-wired phasing harness for even easier use!

Standard Aerial	£30.76
As above, but with integral preamp	£48.93
Carriage & Insurance	£5.00

Martelec Ltd.
108 Queens Road,
Farnborough,
Hants. GU14 6JR
Tel: Farnborough (0252) 515666
Telex: 859489 (MARTLC G)

VISA Access

MSS20 BBC BASED DECODER/SOFTWARE PACKAGE

Complete built and tested interface, designed for owners of Acorn model B, B+, and Master micros. This exceptional hardware/software package produces weather sat pictures as never before on a BBC. Host of excellent software features make this the best value system available anywhere, whether for educational or general interest usage.

Features include:-

- Zoom - x2, x4, x8
- Greyscale control for vis or I.R.
- User-defined colour palette
- North/South picture invert
- Printer dump (FX80 formats)

NOTE:- The MSS20 system is capable of really excellent results, and should not be confused with other, inferior, BBC-based systems from elsewhere.

Send £3 for the demonstration disc and see for yourself.

£86.19

*** * * * NEW * * * * NEW * * * * NEW * * * ***

ARCHIMEDES-BASED WEATHER SATELLITE SYSTEM

At the time of going to press, this new Spacetech system should be available. It comprises a podule for the Arch, and embodies many advanced features for picture manipulation and control. Full details available on request. **Approx. price £250.**

MSG20 GRAPHSTORE - HI-RES FRAMESTORE

Graphstore is a powerful high-resolution framestore, for use with the Acorn model B, B+, and Master micros, with built-in graphics processor for unparalleled picture processing power. Basic operating mode gives two hi-res pictures of 512 x 512 x 128 grey levels. Alternate animation gives eight pictures of 256 x 256 x 128 grey levels.

Features:-

- * Zoom any factor from 1 to 16
- * Smooth X-Y Scrolling
- * Disc Dump and Read
- * Post Reception Processing (PRP)
- * Picture Animation (up to 8)
- * Facsimile Option (available soon)
- * Contrast Enhancement
- * Printer Dump Routine (available soon)

Graphstore is a professionally-built system with extensive upgrade potential - usually in software. It is fully assembled, tested and cased, with its own internal PSU, all leads and manual, and software.

	£399.91
Carriage & Insurance	£7.20

OTHER KITS AND BITS.....

MSK20 137MHz Preamplifier	- kit	£10.95
	- built	£19.95
YU3UMV Framestore *	- (64K)	£80.72
	- (128K)	£94.97
LOK Sync Board Kit		£25.85

* Temporary price increase due to World memory shortage.

THE WEATHER SATELLITE PODULE

At last, at an affordable price, a truly professional weather satellite image decoding and display package which matches and, in nearly all cases, exceeds the specification of the most sophisticated and expensive systems currently in use. The speed, flexibility, and raw processing power of the Archimedes are harnessed to give fully animated pictures from space with photographic clarity in colour or high resolution monochrome. Avaiable now for all Archimedes systems.

Ask for a demo disc: *Interactive, carousel or animation.* £5.00 each refundable.

- Digital signal processing in hardware and software
- Automatic data capture
- Automatic receiver control
- Automatic printer dumping
- Automatic level settings from satellite calibration data
- Up to 200 compressed frame animation
- Up to 58 Hi-res frame animation
- Smooth fast pan and zoom to any level over entire image
- 256 colours or 84 grey levels at up to 512x640 resolution
- Advanced 'paint box' colour wash facility

spacetech
space science resources
21 West Wools
Portland Dorset
DT5 2EA

Access

Tel: 0305 822753

Acorn
The choice of experience

Write or phone for our latest list of satellite equipment and publications: books, posters, prints, slides videos etc.
Demo discs for Atari ST also available; Atari system ready late summer.

GAREX ELECTRONICS

***** TIMESTEP WEATHER SATELLITE SYSTEMS *****

SPECTACULAR NEW ATARI *ANIMATED* SYSTEM Garex are proud to announce that they are the first appointed dealer for this incredible new Timestep product. Following on from Timestep's phenomenal success in the education market, a special low cost Atari ST version of their *animation* system is now available from stock. Simply plug in your existing receiver to view amazing pictures. For the ultimate add a Meteosat receiver for unbelievably smooth 14 frame *animation* that is completely automatic once set up. Just watch the clouds roll by ! New pictures are added twice an hour if required, the oldest being discarded automatically. This sophisticated package will run on any Atari ST1040 and compatible colour monitor. Complete with all software and colour-keyed Atari interface. This equipment is of such high quality that Atari UK exhibited it on their stand at Which Computer 1989 !
Interface and software, just connect your existing receiver. £299.00
Optional colour to 16 grey scale adaptor. £24.95
For those who would like a one-stop-shop, the complete package ready-to-run :
Meteosat Dish, Pre-Amp and Receiver, 43M cable, Atari Interface, Grey Scale Adaptor, 14" Colour Monitor, Atari ST1040, Software (including demonstration disc) and, of course all other cables and connectors. On your doorstep £1,695.00

COMPACT FRAMESTORE SYSTEM The *BASIC* MICROWAVE METEOSAT system. For no complications a complete plug in and go package that requires no computer, no software, no extra monitor and can be up and running, including dish alignment within 10 minutes of receipt. 256 x 256 pixels and Timestep's digital 64 grey level output gives outstanding results. This is the system that the London Science Museum has chosen to display in the new Space and Exploration Gallery, for the next 12 years !. Stop press. Did you notice this equipment giving **totally** noise free pictures live at Sandown Park ?.
Nothing more to buy:
Meteosat Dish, Pre-Amp and Receiver, 43M cable, Framestore, 12" B/W Monitor and, of course all other cables and connectors. £995.95
Also available less monitor. £885.00

AMIGA AMIGA AMIGA !! Available from stock now. Amazing 600x400 pixels in 16 shades of grey on a standard monitor. Runs on any A500 1Mb. Interface and software only £299.00. Use your existing receiver !.

IBM IBM IBM STOP PRESS !!! See the Timestep advert for this systems to put all others in the shade.

SATELLITE ACCESSORIES

Meteosat receiver. Dish input and 2 watt audio output. £270.25
Meteosat Pre-amp. 15dB gain 0.6dB noise figure GaAs FET. £92.00
Meteosat dish, 0.9M with feed horn. £199.00
10M H100 fitted N connectors. £29.85
NOAA *BASIC* Turnstile antenna, ready wired phasing harness and a connector fitted, complete with mast bracket. £39.95
NOAA *BASIC* Pre-amp, 3 pole filtering, boxed and fitted with connectors, 14dB gain 1.0dB noise figure, for the Turnstile antenna. £24.95
NOAA cable, 50M high quality cable fitted with connectors. £24.95

ALL PRICES INCLUDE UK P&P AND 15% VAT.
***** ACCESS & VISA WELCOME *****

GAREX ELECTRONICS
HARROW HOUSE AKEMAN STREET TRING HP23 6AA
Tel. Tring (044282) 8580 and Cheddington (0296) 668684
Callers by appointment.

FENWAY WEATHER SYSTEMS PRICES

Fenway Weather Systems are proud to be the distributor of the TIMESTEP-DIGITAR range of weather stations. Now for the first time, these beautifully made American instruments are available at sensible low cost prices.

TWR-3 A tiny, completely stand alone unit featuring :-
Wind speed. Wind direction. Wind chill factor. Wind gust record. Outside or inside temperature. High/low temperature record. Metric or imperial. 12/24 hour clock. Scan feature. Daily and yearly rainfall optional.
TWR-3 £99.50 RG-3 Rain collector £36.95

WD-2 A small completely stand alone unit featuring :-
Wind speed and alarm. Wind direction. Wind chill factor. Wind gust record. Outside temperature and alarm. Inside temperature and alarm. High/low temperature alarm. Metric or imperial. 12/24 hour clock. Programable scan feature. Daily and accumulated rain fall optional. Calendar. Illumination.
WD-2 £149.95 RG-2 Rain collector £36.95

PCW A unique, totally computer controlled weather station. Any standard PC type computer with XT or AT expansion slots can be used. Operating in a "background mode", this weather station will enable your PC to carry on working on your business software as normal. Data will be stored for recall later. Featuring :- Sea level barometric pressure. Wind speed and alarm. Wind direction. Wind chill factor. Wind gust record. Outside temperature and alarm. Inside temperature and alarm. High/low temperature store. All metric and imperial units. 12/24 hour on board clock. Daily and accumulated rainfall optional. PCW-PRO software optional.
PCW £199.95 RG-2 Rain collector £36.95

PCW-PRO Incredibly sophisticated automatic data logging software for the PCW. This software automatically plots each parameter in easy to understand 24 hour graphs. Identifying trends has never been easier !. Days, months and even years, may be automatically stored on disc for analysis in the future. For the advanced user a conversion program is included to produce ASCII files for database and spreadsheet applications. ASCII file dumps for other program use such as databases and spreadsheets. **PCW-PRO £59.95**

PCSAT+ Come and see this incredible weather satellite system running live. With the optional VGA600 card it will display 800 pixels, 600 lines and 256 colours simultaneously on the screen. Compare it side by side with the framestore and see the amazing 7 times better resolution in monochrome and 27 times improvement in colour. If you already have a Meteosat receiver the cost is just £299.00 for the Interface, Interface Card and software. The VGA600 card is available at £299.00.

VAT at 15%. Carriage extra. ACCESS, MASTERCARD and VISA welcome.

Fenway Weather Systems
Victoria Way Industria Estate Newmarket CB8 7SH England
Tel. 0638 665300 FAX. 0638 666555

TIMESTEP PCSAT+

The PCSAT+ is a new addition to the low cost Timestep *MULTISAT* range of weather satellite equipment. It will run on every computer from an XT or clone with CGA, right up to a 386 with 800x600 pixels. The system is configured to allow easy upgrades, for example if screen resolution is important, then the Timestep VGA600 card can be fitted to an ordinary XT to give 800 pixels, 600 lines and 64 grey levels. For very low cost use a special mode is provided for the Amstrad 1512 which fully exploits it's almost unused grey scale mode.

The YU3 framestore used to compare computer systems is now finally put to bed. The Timestep *MULTISAT* with VGA600 gives 800x600x64, a staggering 7 times better than the framestore's 256x256x64. The VGA600 gives a completely flicker free display unlike the Amiga and some other systems. The VGA600 can also use colour and display 800x600 in 256 colours at the same time on the screen, an incredible 26 times more resolution than the framestore !

The image is stored on disc in *full satellite resolution.* This may be displayed in ZOOM format so that every pixel is shown, even in CGA. Later when you expand your system with a better graphics card, you will find that all the information stored on your old equipment can be viewed in as high a quality as the satellite allows.

High speed flicker free animation of 10 images in 300x400 in 16 greys is available with EGA and VGA systems.

Every Timestep *MULTISAT* comes complete and ready to run from Meteosat or GOES, just add a suitable Meteosat receiver, computer and monitor to receive live pictures as often as every 4 minutes. The software supports most VGA modes if you already have a VGA card fitted.

Features

Display up to 800x600 in 256 colours

ZOOM into *full satellite resolution*

Animation of 10 300x400x16 images

Works with standard XT clone computers

Easy and cheap upgrade path

Store *full satellite resolution* data

Greys shown on a standard VGA monitor, EGA and VGA need a Multisync GS monitor to show grey scales.

Standard hardware provided

MULTISAT interface

PC 1/2 size interface card

Software discs

Comprehensive manual

Price for all items listed above £299.00.

Options

VGA600 video card giving 800 pixels, 600 lines and 256 colours or 64 greys and amazing hardware high speed ZOOM window in X1, X2, X3 and X4. £299.00

VGA Paint. A brilliant paint package that will handle all VGA modes in both colour and greys. £99.95

VAT at 15%. Carriage £9.95 on *MULTISAT*, £4.50 on other options.

TIMESTEP WEATHER SYSTEMS
WICKHAMBROOK NEWMARKET CB8 8QA ENGLAND
Tel. 0440 820040 FAX. 0440 820281 Telex 817015 TIMEST G